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Policy

The U.S. Navy Medical News Letter is basically an official Medical Department publication inviting the attention of officers of the Medical Department of the Regular Navy and Naval Reserve to timely up-to-date items of official and professional interest relative to medicine, dentistry, and allied sciences. The amount of information used is only that necessary to inform adequately officers of the Medical Department of the existence and source of such information. The items used are neither intended to be, nor are they, susceptible to use by any officer as a substitute for any item or article, in its original form. All readers of the News Letter are urged to obtain the original of those items of particular interest to the individual.

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SPECIAL ARTICLES

SECOND ANNUAL SYMPOSIUM ON TRAUMA

The Second Annual Symposium on Trauma was held at the Naval Hospital, Camp Pendleton, California, on 25 and 26 April 1969. The theme of the meeting was "The Role of the Naval Hospital in the Management of Trauma." The conference was attended by approximately 500 military and civilian physicians. Moderators and speakers came from as far as Vietnam and the East Coast to participate.

To add to the context, numerous exhibits were displayed of modern military hardware, field medical and dental equipment, and current medical research projects. The exhibit entitled, "The Early Fitting of the Amputee," was narrated by Mr. Charles Asbelle, for many years Supervisor Rehabilitation Specialist at the Naval Prosthetics Research Laboratory at the Naval Hospital, Oakland. Two other fine exhibits were "Technique of the Mesh Skin Graft," narrated by LCDR R.B. Salisbury, MC USNR, from the Department of Orthopedic Surgery, Naval Hospital, Camp Pendleton, who has worked with this project since its inception; and a medical photographic exhibit, "The Surgery of Trauma," picturing medical scenes aboard the U.S.S. SANCTUARY, while taking casualties offshore, Vietnam, by CDR F.E. Jackson, MC USN, Chief of Neurosurgery, Naval Hospital, Camp Pendleton.

Highlighting the activities on the first day of the Symposium was the Combat Demonstration staged by elements of the 5th Marine Division. The Marines simulated an attack on a fortified position utilizing close air support. The reconnaissance personnel were brought in by helicopters and rappelled down long ropes to open the attack, then the assault Marines were brought in by C–46 helicopters. The attacking Marine infantry units were supported by weapons that are integral to the Marine battalion, namely, rockets, satchel charges, rocket launchers, and flame throwers. At the height of the attack, elements of the Marine Air Wing stationed at El Toro, California, were called in for jet air strikes and simulated napalm drops to remove obstacles blocking the path of the assaulting troops. The Navy Corpsmen, who were well identified by white helmets for this exercise, demonstrated the methods of removal of wounded Marines from the battlefield, including the use of the sling hoist and direct loading into helicopters to the 5th Medical Battalion which was set up 500 yards from the assault area. Here, Navy physicians and corpsmen, utilizing moulages, demonstrated the principles of triage and resuscitation of patients in shock. Complete operating rooms and techniques were displayed just as they appear in Vietnam.

So successful was the meeting that a Third Annual Symposium on Trauma is planned for the Naval Hospital, Camp Pendleton in the spring of 1970.

The subject matter presented at the Second Annual Symposium on Trauma is revealed in the following abstracts.

DESIGN AND STAFFING OF EMERGENCY ROOMS

John E. Scott, MD MPH, Deputy Chief, Neurological and Sensory Disease Control Program, Health Sciences and Mental Health Administration, Arlington, Virginia.

It is a pleasure to be here today to present a point of view resulting from several years of investigation into emergency room services. I come from the Division of Chronic Diseases of the Public Health Service and it may appear unusual that someone involved with chronic diseases should be interested in emergencies which can hardly be described as chronic. However, head injuries and their chronic sequelae

are definitely tied together. In fact, many chronic diseases start as acute emergencies and the resulting chronicity is frequently dependent on what happens in the first 24 hours.

It would be presumptuous of me to try to deal with the whole complex matter of emergency room design and staffing in these few minutes; however, I would like to dispose of a number of prevalent misconceptions about emergency services. First, let me say that in discussing emergencies, I am not talking about head injuries alone. I am talking about the whole range of acute conditions from psychiatric to traumatic.

One misconception is that doctors can educate patients in the community as to what a real emergency is. Patients defined their own emergencies. To them, they often have a psychological, economic, or social basis as well as medical. A physician often becomes hostile and frustrated because he traditionally defines the emergency as only medical.

One hospital I visited had just built a new outpatient department and the hospital administrator was proudly showing me his glistening emergency room with all the latest equipment. On the walls of the waiting room hung a number of large yellow signs, beautifully lettered by the hospital auxiliary, saying essentially, "Shame on you for being here if this isn't an emergency." From what he told me, patients ignored the signs and kept coming in the usual number. That was a hospital that was still fighting the emergency room, fighting the patient's definition of his own emergency, and ending up only with poor public relations. Only after we have admitted that the patient does and will continue to define his own emergency can we more intelligently plan for appropriate triage to handle the expected load. Admittedly, this will be a bold concession for the medical profession to make, but it must be made before the barriers of the past can be overcome and planning can proceed. It is a "great divide" that must be crossed. We hear a lot about abuse of the ER, but if we decide to accept the patient's definition of an emergency, I think we will find abuse is not so common as has been assumed.

Another misconception about the emergency rooms is that the care given there is first-aid. First-aid is a term that defines what one does at the roadside or in the field beside a tractor. Certainly, a tracheotomy, shock therapy, chest stabilization or defibrillation of a writhing ventricle are not first-aid. A modern sophisticated well designed ER is a highly complex department of the hospital.

This brings us to the next misconception; that is, that any doctor is good enough to give emergency room care. Staffing of emergency rooms should be based on the premise that the patient deserves the best of medical care at the most important time of his illness. I am afraid that the opposite is often true. Even when there is coverage by interns, it is frequently poorly supervised. Today many ER physicians have a language difficulty because house staff is frequently made up of foreign speaking physicians. In hospitals without interns or residents, which, incidentally, compose about 80% of them in this country, emergency rooms are covered by the "take turn system" where members of the staff must take their turn in the emergency room in exchange for privileges on the hospital staff. Staff specialists which make up the bulk of the staff are understandably uncomfortable in this role. Likewise patients seeking services in an emergency may be subjected to considerable waits while the on-call physician locates the appropriate specialist for the patient's condition. This "take turn system" is loudly lamented by staffs of the hospitals I've visited, but no one has any other solution.

It appears that the physician of the future will be even less well prepared to handle the general emergency, since fewer and fewer medical students are selecting rotating internships.

All this leads to a cause I have been championing for several years, and that is, the development of a new specialty of emergency service physicians. Full-time emergency service coverage by such a full-time on-the-job trained specialists now exists in a handful of the nation's hospitals. Where it does exist, there has been a marked improvement in emergency care coverage and it has been well accepted by community physicians. Some 300 such specialists of this new breed have recently formed a national association.

A physician specially trained in the emergency aspects of each specialty, working full-time with full responsibility for all aspects of emergency services, respected by his colleagues as a specialist, and placing his professional reputation behind the excellence of the emergency care unit is a pattern which is emerging all too slowly. The excellence of other hospital departments, such as radiology, anesthesiology, and X-ray depends upon the guy in charge. So be it in the emergency unit.

The role of such a full-time specialist would take him well beyond the walls of the emergency room of the hospital. His responsibility in the area of civil defense and disaster planning, for instance, is ob-

vious. Ambulance services of the fire departments, police departments, funeral parlors, and voluntary units are his concern. Liaison with and training of rotating medical staffs of smaller "feeder" hospitals sending patients to emergency centers are other important functions. Development of helicopter services, guaranteeing around the clock staffing, keeping equipment up to date and working, and enforcing ER discipline are other roles he has.

In conclusion, I would summarize by saying that we must accept the patient's definition of an emergency and plan for handling the load accordingly; that we must prepare a specialist in emergency care who can cope with the broad community problems involved as well as the clinical ones; and that we must plan for the future improvement in emergency medical services in accord with the changing pattern of physician training.

PULMONARY RESUSCITATION FOLLOWING TRAUMA

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Introduction

Life depends upon the continuing ability to breathe. Failure of respiratory gas exchange is the most frequent single cause of death. In the case of the traumatized patient, care of the respiratory tract usually assumes priority over all other considerations, including hemorrhage.

The importance of this problem is underscored by the fact that 25% of traffic fatalities are the result of thoracic wounds. In World War I, 20 to 30% of the deaths occurring on the battlefield were the result of thoracic injuries. The benefit to be gained by prompt and proper early management can be appreciated if one compares the results obtained in World War I with the results under similar circumstances in the Vietnam War. The mortality rate of those patients with chest injuries who reached medical care in the first war was 25%, whereas in the present conflict the early mortality rate is only 1.2%.

This presentation will attempt to outline the steps to be taken to insure that adequate respiration is maintained. While there will be emphasis upon the patient who has suffered trauma to the chest, nevertheless the same principles are applicable regardless of the nature of the patient's injury.

Characterization of the Respiratory Defect

Pulmonary resuscitation implies attention to the respiratory mechanism in its broadest sense. The entire ventilatory apparatus must be considered, and will be discussed under the headings of Upper Airway, Thoracic Bellows, and Gas Transport.

A. *The upper airway* includes all of the air passages concerned with transmitting ambient air down to the respiratory units of the lung. The principal defect which may occur in the upper airway is obstruction. This may take the form of occlusion of the oropharynx by the prolapsed tongue, blood, foreign material, vomitus, or by relaxation of the jaw in the comatose patient. Farther down the airway, the obstruction may be caused by direct trauma to the trachea, or may be due to the presence of blood clots or mucus plugs or foreign material within the bronchial tree. Obstruction may also be caused in the bronchial tree by mucosal edema and by bronchospasm.

B. *The thoracic bellows* frequently are not appreciated sufficiently during the evaluation of the traumatized patient. The dramatic appearance of a sucking chest wound usually elicits prompt and appropriate action on the part of the attending personnel. However, the unstable chest wall resulting from multiple fractures of several ribs produces a more insidious, but no less devastating effect. The paradoxical motion of the unstable portion of the chest wall markedly diminishes the efficiency of respiration, and with the addition of the associated pain, renders effective coughing impossible. The pleural space is often overlooked as an important component of the thoracic bellows. The lung cannot function efficiently unless the visceral and parietal pleurae are in contact with each other. A pneumothorax or hemothorax must be promptly corrected before complete pulmonary resuscitation can be accomplished.

C. *Gas transport* refers to the movement of oxygen into and carbon dioxide out of the blood stream at the alveolar level. Most of the problems encountered are due to abnormalities of ventilation and perfusion. In any case wherein blood passes through the lungs

and returns to the heart without having come into contact with ventilated alveoli, a right to left shunt exists. True shunts exist anatomically at the precapillary level, and approximately 4% of the cardiac output may pass through these anatomic shunts under normal circumstances. Physiologic shunts exist when alveoli which are not ventilated are nevertheless still perfused. The degree of the physiologic shunting may be increased under any circumstances wherein there is atelectasis or where there is uneven ventilation of the lung, such as is the case in the injured patient who may be lying immobile with inadequate excursion of the chest wall. There is, in addition, a shunt-like effect which is brought about by bronchospasm and is the result of continuing perfusion to partially ventilated alveoli.

A diffusion defect is uncommon in the acutely traumatized patient, but can result from changes which impede the transport of oxygen, such as edema, congestion, and thickening of the alveolar septae. Finally, gas transport is influenced by the state of circulation. If the patient is in hypovolemic shock, he may not have sufficient circulating blood volume to deliver the amount of oxygen required. In addition, the pumping mechanism may not be effective due to pre-existing myocardial disease, myocardial trauma, or as a result of pericardial tamponade which interferes with the diastolic filling of the heart, thereby reducing cardiac output.

Recognition of the Respiratory Defect

A. *Physical signs* of upper airway obstruction are fairly obvious. There is usually noisy breathing or stridor, and the physical efforts of breathing are markedly increased. However, a totally obstructed airway produces no noise at all. If the accessory muscles of respiration come into play, there is intercostal space retraction and a paradoxical retraction of the abdomen as the chest attempts to expand.

A disturbance in the action of the thoracic bellows will be manifested by abnormal motion of the chest wall. In the event that several ribs are each fractured in more than one place, paradoxical motion of the unstable portion of the chest wall results. An open wound of the chest wall will be obvious. The presence of a pneumothorax or hemothorax can usually be detected by diminished to absent breath sounds over the affected hemithorax, with either tympany or dullness to percussion. The mediastinum may be displaced away from the affected side as manifested by a shift of the area of cardiac dullness and a palpable deviation of the trachea. If a tension pneumothorax exists, the patient may be markedly dyspneic and often will be cyanotic.

B. For any abnormality of the pleural space, the most useful laboratory test is the chest X-ray. This should be obtained with the patient in the upright position, either sitting, or in the lateral decubitus. Supine A-P roentgenograms may be deceiving because blood may layer behind the lung, or free air may layer in front of the lung, and their extent may not be appreciated fully. It should be emphasized, however, that a prompt thoracentesis should be performed with a large bore needle without hesitation if the presence of air or blood in the pleural space is suspected. This should be done if an X-ray examination is not immediately available, or if the patient is too ill to be X-rayed. A bilateral thoracentesis should be performed if there is any doubt as to which side is involved.

C. *Defects in gas transport* may be suggested by the presence of tachypnea, dyspnea, tachycardia, or cardiac arrhythmias, and cyanosis. Useful laboratory studies include measurement of the minute ventilation to judge hypoventilation, and most important, blood gas determinations. The arterial PO_2 usually will be depressed. Because of the patient's attempt to compensate by hyperventilation, the PCO_2 usually will be depressed and the pH will be elevated. Hypoxemia due to hypoventilation may be differentiated from that due to abnormal ventilation/perfusion by the arterial PCO_2. In hypoventilation, the PCO_2 will be elevated. If uneven ventilation/perfusion exists, the PCO_2 will be normal or low. The single criterion for normal alveolar ventilation is a $PaCO_2$ of 40. Determination of the alveolo-arterial oxygen gradient and of the pulmonary shunt fraction in those patients with abnormal ventilation/perfusion ratios usually will demonstrate these to be elevated.

Treatment of the Respiratory Defect

A. *A patent upper airway* frequently can be obtained by clearing foreign material from the back of the throat, drawing the tongue forward, and supporting the jaw. An oropharyngeal or nasopharyngeal airway may be inserted. In general, if intubation of the trachea is necessary, it is best to accomplish this by means of an orotracheal tube or a nasotracheal tube. Even if it appears that a tracheostomy inevitably will be needed, it is best to intubate the trachea through the mouth first, so that the tracheostomy may be performed in an elective manner. Oral or nasal tracheal tubes may be relied upon for up to 48 hours without difficulty. Occasionally, they may

give rise to temporary hoarseness and to granulations of the vocal cords. They also have the disadvantage that adequate suction of the tracheobronchial tree is difficult through such tubes. These tubes are preferable, however, to a poorly positioned tracheostomy, and are less likely to result in tracheal stenosis.

B. *A tracheostomy* is indicated in instances of trauma to the oropharynx, in situations which will require prolonged respiratory assistance, and on occasions when adequate tracheobronchial toilet presents an unusual problem. In order to prevent the increasing incidence of complications from tracheostomy, the procedure should be executed under the best possible circumstances with adequate ventilation, light, assistance, instruments, and suction. A vertical skin incision will result in the lowest incidence of poorly positioned tracheostomy tubes. The tracheostomy should be placed as high as possible in the cervical trachea, because a subsequent stricture is much more easily managed in the cervical than in the mediastinal trachea. A cuffed tracheostomy tube should be employed because usually ventilatory assistance will be desired. However, great care should be exercised to avoid overinflation of the cuff. Ischemia of the tracheal mucosa occurs as a result of excessive pressure within the inflatable cuff, and the pressure is more likely to be excessive in the presence of hypovolemic shock and reduced tissue perfusion pressure. It is probably best to inflate the cuff until it is barely occlusive, and then to remove a slight amount of air, accepting thereby a small air leak around the cuff.

C. *Disturbances in the mechanism of the thoracic bellows* should be treated according to the defect which is present. The emergency initial care of open chest wounds requires an occlusive dressing. Subsequently, the wound should be debrided and closed. Occasionally, it may be necessary to mobilize a muscle flap to obtain air-tight closure of the chest wall. *The emergency initial care of an unstable chest wall is to splint it with a bulky dressing.* While this may hold the unstable portion of the chest wall in a depressed position, this is better than permitting it to move in a paradoxical fashion. Following the patient's arrival on a hospital ward, the chest wall may be immobilized either by traction or by internal pneumatic splinting by means of positive pressure breathing. If the patient must be transported, he should be moved either in a semi-sitting position or with the injured side down.

D. *The pleural cavity must be vented.* Following thoracentesis to establish the diagnosis, a thoracostomy tube should be inserted. If there is a pure hemothorax, the tube should be placed in the fifth intercostal space in the midaxillary line. If there is an associated pneumothorax, an upper tube should be inserted, preferably through the second intercostal space in the midclavicular line. If the patient must be transported, the tubes may be connected to a flutter valve of the Heimlich type. However, if the patient is in a hospital, it is best to connect the tubes to underwater seal and suction. Pain relief will help the patient to move his chest wall. This may be achieved by the judicious use of narcotics or intercostal nerve blocks.

E. *The treatment of defects in gas transport* usually involves the administration of oxygen, most often in concentrations higher than that present in the ambient air. Concentrations of oxygen greater than 50% should be avoided if possible because it may be that high partial pressures of oxygen in the inspired air may contribute to lung damage. Unless there is extensive damage or obstruction to the alveoli, the elimination of carbon dioxide does not present a problem. Adequate ventilation may require assistance, especially in the presence of decreased compliance. Drug therapy is of relatively little value in pulmonary resuscitation. The most useful adjunctive drugs are sodium bicarbonate to help combat metabolic acidosis, and bronchodilators. Steroids are occasionally of value in situations wherein there is pulmonary edema, damage to the integrity of the capillary wall, and to reduce the inflammatory response following aspiration. It should be pointed out that steroids have been employed empirically and that their mechanism of action and their role in pulmonary resuscitation is still not established.

While I have said little about the treatment of associated hypovolemic shock, this should progress simultaneously with the efforts at pulmonary resuscitation. Hemorrhage should be controlled, large bore intravenous cannulas should be inserted for the administration of fluid, a central venous pressure catheter should be inserted, and the possibility of cardiac tamponade should be considered. *Deficits in circulating blood volume should not be overcorrected* by excess administration of fluid because of the increased susceptibility of the severely injured patient to the development of the "shock lung."

Respirators

Most respirators in general use are either one of two varieties. Either they are pressure limited with a variable volume, or they are volume limited with a

variable pressure. The essential factor is the amount of air which they are able to move. Both types of respirators require attention, and in the final analysis, the operator is perhaps more important than the particular type of machine in use. The use of a respirator is indicated whenever there is a *change* in a previously acceptable ventilatory picture. A PCO_2 over 50 or a PO_2 under 50 in a person without previous lung disease is an indication for respiratory assistance.

A. *The pressure limited respirator* delivers an amount of air directly proportional to the compliance of the lung. It will adjust for leaks in the system. It will increase its rate when there is a decreased compliance, or an increased airway resistance.

B. *The volume limited respirator*, on the other hand, will disregard the compliance of the lung, but it does not sense a leak and a sizable proportion of the delivered air may never reach the lungs. It may decrease its rate with a decreased lung compliance or an increased airway resistance.

The prolonged use of a respirator requires strict attention to proper humidification, sterile tracheal suction technic, close attention to the inflatable cuff, judicious oxygen administration, and frequent patient evaluation. To obtain fully saturated air, heat is required as well as humidity. The humidity may be obtained by the use of either saline or water. Bronchodilators are usually unnecessary. *All detachable parts of the respirator and nebulizer should be sterilized every twelve hours.* Bacteriologic studies have shown that this equipment will usually remain sterile for up to twelve hours, but that pathogens appear by twenty-four hours.

Evaluation and Monitoring of Results

A. Patients undergoing pulmonary resuscitation require *close observation.* Their condition changes rapidly, and appropriate adjustments must be made in their management. Much information can be obtained rather simply. Inspection of the patient provides information regarding respiratory distress, the presence of cyanosis, and will indicate whether both sides of the chest are moving equally and normally. Auscultation will detect noisy breathing, will indicate whether both lungs are being ventilated properly, and will reveal the presence of bronchospasm. Radiography provides follow-up information regarding the full expansion of both lungs. Any time a chest X-ray is made of a patient who has a tracheal tube in place, the position of the tube should be noted. It is a not uncommon event for the tube to enter the right mainstem bronchus with resulting loss of ventilation to the left lung.

B. Laboratory measurements have already been mentioned. It should be emphasized that the amount of effective ventilation which the patient is receiving can be determined best by measuring the expiratory volume. The indicated amount of air being delivered on inspiration by the respirator may not represent the amount reaching the lungs, because air leaks may be present. Blood gas determinations may be obtained on a routine basis, but it is better to obtain them whenever there is a question regarding the adequacy of ventilation. They should be obtained whenever an event occurs such as a change in management, a change in the oxygen concentration of the inspired air, a change in the adjustment of the respirator, or following removal of an endotracheal tube.

Accurate measurement of lung compliance at present is available only in research units. However, "effective compliance" can be readily determined by observing the expired volume and the end-tidal pressure of the respirator. This information is readily available and it reflects both the pulmonary compliance and airway resistance. The degree of shunt fraction can be calculated, but requires additional information. It is, however, proportional to the A-a gradient, and in the case of a patient breathing 100% oxygen, the only additional information necessary to calculate the gradient is the value of the arterial PO_2 and PCO_2.

Summary

In summary, the objectives desired in pulmonary resuscitation are adequate respiration, a clear tracheobronchial tree, a clear pleural cavity, and the restoration of the blood volume. The markedly improved results which have been obtained following the wartime treatment of chest injuries in Vietnam are due in part to the following innovations:

1. The earlier and more frequent use of chest tubes.

2. The more frequent use of positive pressure ventilatory assistance.

3. The use of blood gas determinations as a guide to oxygenation, ventilation, and acid-base balance.

ANESTHESIA FOR TRAUMATIZED PATIENTS

LCDR Eric A. Wahrenbrock, MC USNR, Department of Anesthesiology, Naval Hospital, San Diego, California.

Introduction

I've been asked to speak on Anesthesia for Traumatized Patients. I intend to confine my remarks to anesthetic considerations for major surgery in patients who have been significantly traumatized, since most surgeons and anesthetists would concur that the anesthetic of choice for a patient who has been hit by a truck and who needs to have a toe amputated would be a peripheral nerve block. If properly executed, this anesthetic technic would have little impact on the patient. The situation that I would like to have you keep in mind is the patient who has suffered significant trauma, maybe a combined thoracic and abdominal wound, and who requires major surgery, perhaps upper abdominal surgery on an emergency basis. Rather than present a systematic description of the thoughts of an anesthetist as he considers the anesthetic management of such a patient, which will have considerable impact on the patient's condition, I have chosen to comment on certain aspects of anesthetic management which are of interest to both surgeons and anesthetists. I have deliberately chosen areas in which conflicting opinions have been presented. Sometimes those conflicting opinions were presented by anesthetists and sometimes by surgeons, and on occasion the opinions of the anesthetists and surgeons have conflicted. While all anesthetists know deep down inside themselves that anesthetics are good for people, the question periodically arises as to which anesthetic is best. It must be admitted that now and again this question is phrased in a different way by concerned physicians, but as this appears to be an area of some debate, I have chosen the selection of the anesthetic as the first topic I would like to discuss.

Selection of the Anesthetic Agent

Of paramount importance in emergency anesthesia is the risk of aspiration of gastric contents by a patient with a full stomach. Besides stating that one cannot empty the stomach through a tube, I don't intend to comment further on this matter.

The question is frequently raised whether to use general anesthesia, conduction, or infiltration anesthesia during surgery in a traumatized patient. A number of principles should be borne in mind.

First, the purpose of anesthesia is to make surgery possible, not easy or pleasant. If surgery can be made easy for the surgeon or pleasant for the patient without compromising safety, then so much the better, but the overriding principle is that the patient's safety must not be jeopardized for the sake of convenience.

Secondly, everything else being equal, a well conducted general anesthetic is preferable to a poorly conducted regional technique. The converse of this statement is, of course, also true, and a corollary of this statement is that it is more difficult to begin general anesthesia in the middle of a case than it is to begin at the beginning.

Thirdly, I believe that by and large, the more unstable the patient's cardiopulmonary status, and the larger the intended operative procedure, the more one should lean toward general anesthesia. For example, the patient in shock with a combined thoracic and abdominal injury is generally best managed with endotracheal general anesthesia. It is doubtless possible to manage such a patient during laparotomy, awake, ventilated, intubated, and regionally anesthetized. I fail to see much of inherent value in such a complex technique, and there are many pitfalls.

Lastly, hypovolemia is a firm contraindication to a sympathectamizing anesthetic. Dr. Bonica is a brave and apparently well-insured anesthetist. He bled some human volunteers and then gave them spinal anesthetics. His patients were only a little hypovolemic, so they only got a little bit shocky. There's hardly anything in anesthesia that happens faster than when the bottom falls out after pentothal, or a spinal anesthetic is given to a seriously hypovolemic patient, and hardly anything in anesthesia which is harder to defend. Please bear in mind that there are many ways of inducing sympathectomy during anesthesia: spinal, epidural, or caudal anesthesias are ganglioplegic; Pentothal and other barbiturates, phenothiazine, and narcotics are all alpha-adrenergic blocking drugs.

This brings us to the second matter I would like to discuss about the selection of anesthesia; that is, whether to employ a vasoconstricting or a vasodilating anesthetic agent. The old saw which says that it is not the anesthetic agent but rather the anesthetist which determines the safety of an anesthetic is a

convenient excuse we anesthetists use for not utilizing the differences between anesthetic agents to best advantage.

Cyclopropane augments sympathetic nervous system activity and results in increased levels of circulating norepinephrine, and in normovolemic patients results in increased peripheral vascular resistance, blood pressure and cardiac output. Its fundamental cardiovascular effect is that of depression, like all other anesthetic agents, but that depression is masked by the increased sympathetic activity. It has been shown to reduce splanchnic blood flow only in proportion to the reduced splanchnic metabolic rate. Halothane, while sensitizing the heart to the arrhythmic property of catechols, is not associated with any such increase in sympathetic nervous system activity, and from the very first is a cardiovascular depressant. It is a vasodilator drug in both the systemic and the cerebral circulation. Although there is considerable question about the future of flammable anesthetics, it is my contention that cyclopropane has a special and valuable place in modern anesthetic practice, and that place is in the induction of general anesthesia in the patient in hypovolemic shock. It goes without saying that blood volume deficits should be repaired before anesthesia and surgery begin, but the situation regularly arises in which blood volume restoration must be delayed. I know of no other anesthetic technique offering the safety and flexibility of an inhalation induction with cyclopropane. Oxygen, succinyl choline and curare are not generally considered to be anesthetic drugs.

After anesthesia has been induced and the blood volume restored, the question arises as to whether to continue with an agent which augments sympathetic tone. Mark Nickerson and Jacob Fine present convincing arguments that even the "normal" sympathetic response of hemorrhaged subjects, if protracted, is deleterious, and strongly recommend the use of vasodilator therapy. Anesthetists are understandably hesitant about using general anesthetics as peripheral dilators. There is no question that halothane, for example, is a potent vasodilator, but it is also a potent negative inotrope. Not even Nickerson recommends the simultaneous relaxation of the heart *and* the peripheral circulation.

The technique of balanced anesthesia, using nitrous oxide and oxygen, a muscle relaxant drug, and perhaps a barbiturate or a narcotic is intermediate in its effects on the circulation between cyclopropane and halothane. Perhaps the conversion to a balanced anesthetic technique after a cyclopropane induction offers a reasonable compromise between the two extremes.

Blood and Fluid Management

I don't mean to discuss at length individual anesthetic agents or techniques, but would rather discuss more general aspects of care for the anesthetized patient, and would therefore like to move on to a consideration of blood and fluid replacement during anesthesia and surgery. I will first make the statement that there is no question about what the best replacement for blood loss is. It is whole blood. However, since one does not regularly choose to use type specific but uncrossmatched blood, the question now and again arises, "What to do till the blood man comes?" After reducing the concentration of anesthetic, there are only four choices.

The first is to do nothing at all but sit and worry and watch the clock and leave the patient hypovolemic and hypotensive until crossmatched blood becomes available. The second is to use a colloid, such as dextran or plasma or albumin. Since there were no objections when I made the statement that the best replacement for blood loss was whole blood, that implied that after having replaced the blood loss with some colloid, we will also administer blood when it becomes available.

There are a number of people who feel that the additional colloid is not needed after blood replacement has been accomplished, and may even be deleterious. The third choice one has is to use a balanced salt solution. It is my belief that, within certain limits, the use of a salt solution such as lactated Ringer's is a desirable temporizing move. I'd like to defer further discussion of balanced salt solution to the next part of the discussion of blood and fluids, which is subtitled "Two Liters are Good, But Six Liters are Simply Breathtaking," and move on to the fourth option that one has in the treatment of a patient who is hypovolemic and hypotensive during the anesthesia, and that is the use of vasoconstrictor drugs.

Fortunately, the days of the treatment of hemorrhagic shock by pouring in ever-increasing amounts of a peripheral vasoconstrictor such as norepinephrine or phenylephrine are over, and it is now firmly agreed upon that the misapplication of such drugs produces what amounts to whole body ischemia. For the sake of interest and discussion, I would like to restate the other side of this coin.

Let us consider for a moment the patient in whom hypotension simply cannot be tolerated, who has al-

ready been given a certain amount of balanced salt solution, who suddenly during the course of an operation loses additional blood, and whose anesthetist finds, for one reason or another, that crossmatched blood is not immediately available. It may be said in passing that that's probably a punishable offense. While this situation may appear to be somewhat contrived, it arises with surprising regularity, and is most often seen in patients undergoing vascular surgery who have disseminated arteriosclerotic disease, for example, in their coronary or cerebral circulations. It is my contention that the cautious use of vasoconstrictor drugs under these circumstances is not only excusable, but is probably indicated, and I would like to show in evidence a slide of Dr. Jack Moyer's work which shows the favorable renal response to small amounts of a vasoconstrictor drug, in this case norepinephrine, in animals hypovolemic due to hemorrhage.

Fluids

A consideration of fluid management during surgery for trauma is made difficult by the disagreement between the investigators. The question is whether hypovolemia and surgery induce any deficit other than in the plasma volume—that is, is there anything lost besides the shed blood? Shires states that both surgery and hypovolemic shock cause a loss of fluid from the extracellular space into some third space, anatomically poorly defined. Maloney objects to the method of measuring ECF and presents evidence to the contrary. It would appear that there is less debate over the observation that survival studies in dogs support the use of balanced salt solutions in addition to shed blood replacement.

In view of the continuing debate about the validity of extracellular fluid volume measurements, it would appear that the quantitation of loss of fluid into a third space is difficult, and the clinical estimation more difficult still. I might add in passing that all this hedging is designed to avoid my being pinned to the wall by Doctor Orloff during the discussion session of this panel. All in all, it appears that a patient who has suffered both major bodily trauma and a period of hypovolemic shock might be expected to have a deficit of extracellular fluid of as much as several liters. This supports the use of lactated Ringer's as a temporary plasma volume expander. On the other hand, there must be some upper limit to the volume of salt solution which may be safely given. An article appeared in the Journal of the American Medical Association a few years ago which described the use of 14 liters of lactated Ringer's solution in a patient who suffered uncontrollable blood loss during surgery. The patient survived the surgical experience but died postoperatively of pulmonary insufficiency attributed to pneumonia.

There is a certain amount of discussion of late about the relationship between blood and fluid replacement to the development of the wet lung, or congestive atelectasis, following shock or trauma. A salt solution, and apparently any other substance used as a plasma volume expander, will ultimately be distributed among the various compartments of extracellular fluid in proportion to their respective volumes. That distribution seriously limits our ability to permanently expand the plasma volume with anything other than blood, and eventually results in an increase in the volume of fluid in the interstitial space, perhaps including that interstitial space in the pulmonary parenchyma.

In summary, while the data regarding functional ECF changes may permit or even encourage the use of balanced salt solution as an emergency plasma volume expander, it would seem to require a certain conservatism in the elective replacement of the third space losses.

Acid-Base Management

Now let's move on to some brief considerations of acid-base balance during anesthesia. Subsection One is entitled, "I Don't Know What I'm Doing, But His Kidneys Will Keep Me Out Of Trouble," which while comforting, is not altogether true. It may be worth mentioning that the kidney is at a serious disadvantage during anesthesia or hemorrhagic shock; secondly, that the renal regulation of acid-base disorders is relatively slow; and lastly, the kidney may be at a particular disadvantage during metabolic alkalosis.

There are a number of metabolic derangements in banked human blood. These include a low oxygen tension, a high carbon-dioxide tension, a high sodium and potassium concentration, and a very low pH. It is a common clinical observation that patients who require massive blood transfusion develop metabolic derangements which parallel some of the derangements that exist in bank blood. It may be worthwhile pointing out however, that most of the derangements in bank blood may be remedied by ventilating the blood. The PCO_2, which is on the order of 80 or 90 millimeters of mercury, is promptly brought to the patient's arterial PCO_2 on passage through the pulmonary circulation, and as this considerably de-

creases the acidosis, it is mostly a respiratory acidosis. There exists an additional nonrespiratory, or so-called metabolic acidosis, in bank blood. It is related in small part to the anerobic metabolism of the living cells and in large part to the citric acid added to the blood as an anticoagulant. Blood is drawn into a medium which is acid at body temperature because the pH rises when blood is cooled in vitro. Acid is added so that the pH rises to normal during storage at 4° C.

The citrate and lactate concentration of blood is on the order of 15 milliequivalents per unit, and it might be mentioned that the ultimate fate of this citrate is hepatic metabolism to bicarbonate. When all is said and done, the administration of large amounts of bank blood probably results in an alkaline load which the body must dispose of. I don't mean to deny the necessity of examining the acid-base status of patients, especially those who require large amounts of blood, nor do I mean to imply that one should accept metabolic or respiratory acidosis. On the other hand, I question the routine use of bicarbonate when given on a per-unit-of-blood basis, for unless there is metabolic acidosis present other than that temporary one resulting from blood transfusion, there must inevitably result a metabolic alkalosis from the bicarbonate given, both as such and in the blood as citrate.

The last part of this discussion of acid-base balance might be subtitled, "The Brain and the Kidney Don't Always See Eye to Eye," and is intended as another example of the need for moderation in acid-base therapy. The blood-brain barrier effectively excludes hydrogen ions or bicarbonate ions from the brain extracellular fluid, while carbon dioxide diffuses rapidly into the brain according to differences in its partial pressure. Secondly, the brain extracellular fluid is very poorly buffered against changes in carbon dioxide tension because there is no hemoglobin present. With this in mind, let's examine the blood and brain pH changes in a hypothetical patient.

Joe Hypothetical was admitted to the hospital with metabolic acidosis. He was driven by his carotid body to hyperventilate and lower the carbon dioxide tension of his arterial blood. This restored the arterial pH toward normal. Carbon dioxide, however, diffused out of the brain extracellular fluid according to the tension gradient, and left the brain alkalotic. Bicarbonate was excreted by an active transport mechanism from the brain extracellular fluid, lowering the brain pH toward normal, and reducing the total amount of bicarbonate present. This patient may be said to have a compensated metabolic acidosis. If we now give him large amounts of bicarbonate (for example if we give the entire amount of bicarbonate from the Astrup method of calculating base deficit), his peripheral blood will then have a normal bicarbonate concentration and a low PCO_2. This alkalosis will result in the inhibition of respiration and the arterial PCO_2 will rise. Carbon dioxide will then diffuse into the brain, and with the low bicarbonate concentration in brain extracellular fluid already mentioned, this will result in acidosis of the central nervous system. The restoration of brain bicarbonate concentration which results in a normal pH probably takes as long as 24 hours. The injudicious and rapid manipulation of a systemic acid-base disorder in this patient resulted in an unexpected and serious metabolic defect.

In conclusion, I would like to state that few of the problems relating to anesthesia for traumatized patients are unique to the practice of anesthesia. Rather, they are problems of general medical interest. And last—it would appear that a moderate approach to the selection of anesthesia, the management of blood and fluids, and of acid-base disorders is in the patients' best interests.

THE ACUTE PHASE OF AMPUTEE MANAGEMENT (AMPUTEES AND AMPUTATION STUMPS)

LTC Joseph H. Moll, MC USA, Department of Orthopedics, Brooke General Hospital, Fort Sam Houston, Texas.

The present modes of combat in Vietnam have generated a proportionately higher incidence of destructive and ablative wounds to the extremities than previously were experienced in World War II or Korea.

The immediate causes leading to amputation are namely three:

1. Massive destructive wounds or the incomplete traumatic amputation. In this group, there are two rather distinct patterns of injury:

a. The transverse terminal destructive wound which leaves the proximal anatomy of the extremity relatively undisturbed.

b. The tangently destructive wound which extensively involves the proximal anatomy of the extremity in addition to creating a terminal amputation. This pattern of wounding frequently results from detonation of a land mine by the foot soldier.

2. Amputation resulting from vascular repair failures. This type of problem has a triad of factors which are relevant to their treatment:

a. Venous congestion; edema; compartment tension

b. Ischemia and necrosis

c. Infection

These pathophysiological factors often produce a central deep compartment core of extremity involvement with an apparently viable integument.

3. Massive sepsis, either mixed infections or specific gas infections, which, fortunately, occur in low incidence.

The epidemiology of these destructive war wounds can be compared and contrasted to the epidemiological factors producing pathophysiological derangement of any disease or injury. There are three interrelated and interdependent factors:

1. The condition of the host at the time of wounding—nutrition and hydration and even the personality make-up of an individual which tinctures his attitudes and aptitudes toward injury.

2. Environment—the heavily contaminated soils of the combat field produce massive contamination in these destructive wounds. The time-distance factor in staged care of the wounded requires that management be consistent, logical, and technically feasible at all levels of the evacuation chain.

3. Wounding agent—the wounding agent, epitomized by high velocity tactical weapons, transfers tremendous kinetic energy to an extremity and produces considerable injury at a distance from the wound tracts. This all too often produces a cycle of injury; adjacent small vessel thrombosis, tissue necrosis, and infection.

The management of the acute phase in the amputee should be based on sound and logical principles evolved from knowledge of the previously mentioned epidemiological factors.

Considerations in General Management—The Man

Ablative injury produces profound systemic pathophysiological imbalance with massive blood loss and large wound surfaces leading to continued blood loss, protein, and fluid loss. Embolic phenomena are not uncommon and the pulmonary effects of nonthoracic trauma in the first few days following injury can be disastrous. Therefore, adequate blood replacement, hydration, and continual alertness for pulmonary complications is mandatory to maintain systemic homeostasis.

Amputation inflicts marked emotional and psychological wounds upon the patient—loss of body image, feeling of inadequacy and dependence follow a brief period of often euphoric gratitude for survival of the initial wounding. It is at this time that the patient should be mentally prepared for the phased reconstruction and rehabilitation to come.

The massive contaminated wounds require appropriately heavy antibiotic coverage. Recent reports on the bacterial flora causing significant wound infections in these casualties leave some question as to the efficacy of the routine use of Penicillin and Streptomycin. Other antibiotics with better gram negative coverage, such as Colymycin and Keflin, should be considered.

Regional Considerations in Management—The Limb

Initial evaluation of the involved extremity or extremities should be carried out, bearing the principle in mind that all efforts should be made to conserve length and all determinants of gait in the remaining part of the extremity. Preservation of a very short below-knee segment, even if requiring debridement and arthrotomy of the knee joint, is of unequivocal value to that particular amputee. Similar circumstances exist in destructive foot injuries where it is tempting to perform a first stage Syme amputation at the initial surgery. It is preferable to radically debride the foot and spare an intact tibiotalar articulation to protect both the heel pad and the tibiotalar joint from necrosis and sepsis, which would preclude a satisfactory staged Syme amputation in the reconstructive stages of amputation surgery.

Thoughtless amputation through a fracture site in a mangled extremity needlessly sacrifices length. Fractures will heal in amputation stumps and the additional length is invaluable.

Local Considerations in Management—The Stump

The creation of an optimal stump wound is that which is characterized by the excision of all necrotic and nonviable tissue, freedom from dead space or

potential dead space, and adequate drainage. Such a stump wound will go on to uneventful initial healing with only minor surface contamination or infection. Attempts at creating flaps of a subcutaneous tissue and skin at the initial surgery actually produces further tissue injury at some distance from the terminal wound. Subsequent necrosis and infection often ensues from varying degrees of dead space, suppurative collection and ensuing fibrosis which often precludes satisfactory and safe reconstructive revision to an optimum stump.

Splinting of an amputation stump aligns and supports the stump, prevents skin retraction, and affords wound drainage. The proper and continuous application of skin traction is mandatory. Such a system of skin traction entails three basic precepts:

1. The adhesive should be adherent to the skin to the wound edge to obtain even protraction.
2. Only the wound surface should be dressed.
3. The traction should be light but continuous.

Stump Wound Closure

Timing and method of stump wound closure is critical. By far, the safest method is closure by skin traction with progressive healing of the wound from the depths to the surface. Microporous tape closure, essentially a skin traction method, is useful in closing irregular stump wounds. Delayed suture closure is dramatic when successful because it accomplishes full thickness coverage with one procedure. However, the hazard of needle and suture perforation of contaminated wound surfaces with subsequent hematoma formation, however minute, beneath flaps all too often results in varying degrees of marginal flap breakdown or deep infection with subsequent fibrosis, even when healed. Therefore, the suture method creating full thickness coverage neither produces an optimum stump for definitive prosthetic fitting nor does it produce the optimum field through which late reconstructive revision to an optimum stump can be most safely performed.

Summary

Combat amputation surgery, like all treatment of combat wounds, is based on sound and safe principles of initial debridement and delayed closure gaining uncomplicated healing and phased reconstruction.

MEDICAL ARTICLES

PUBLIC HEALTH PROBLEMS RELATING TO THE VIETNAM RETURNEE

COL Jerome H. Greenberg, MC, USA, JAMA 207(4):697-702, January 27, 1969.

The large numbers of military personnel and ships and planes returning from Vietnam present the possibility of introducing a variety of infectious diseases into the United States. Thus far, only malaria has been diagnosed in significant numbers of patients, while plague presents a threat primarily through the possible importation of infected rats and fleas. Current control programs and conditions in the United States make it extremely unlikely that any of the diseases present in Vietnam will be introduced into the United States and become serious public health problems. Sporadic cases and localized outbreaks may occur, however, and will present a problem for individual medical practitioners and local public health personnel.

The migration of populations and movement of military forces have long been known as important factors in the spread of disease. For the first time in our history, the majority of soldiers returning from a conflict are coming back by air. In 1968 alone, over 290,000 US Army personnel are expected to return from Vietnam. It takes less than 24 hours to return from Vietnam to the United States, which makes it possible to arrive back in the preclinical stages of almost every infectious disease. One of the concerns of the US Army Medical Service, of the Public Health Service (PHS), of state and local public health personnel, and of the medical profession generally is the possibility that diseases introduced from Vietnam may gain a foothold in the United States.

The purpose of this communication is to present

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some of these possibilities, with use of such data as are available. Unfortunately, even the most objective analysis can only lead to speculative conclusions on this subject. However, an attempt will be made to speculate intelligently. In this regard, most of the news coverage of the disease potential in military personnel returning from Vietnam has been good. There have been a few overenthusiastic reports referring to "medical time bombs" and menacing, new, Oriental, venereal diseases, but these have been in the minority.

The first step in determining what diseases of epidemic potential might be brought into the United States from Vietnam is to determine what diseases are present in Vietnam. One is tempted to say "all diseases," but that is not quite true. There is no yellow fever in Vietnam, and, as far as is known, epidemic typhus, relapsing fever, and smallpox are not now present. Schistosomiasis has not been reported, but it has been found in neighboring countries and may be present. Except for the diseases just mentioned and a few others, the majority of infectious diseases of military significance are present. However, US military personnel are not at risk equally to all of these diseases. Therefore, in this communication, the various diseases have been divided into two groups: those which have not been a serious problem in US troops but remain a threat, and those which have already had or are suspected to have had a significant incidence.

Potential Disease Problems In US Personnel

Tuberculosis.—Tuberculosis is widespread in Vietnam, as it is throughout most of the Far East. It has been estimated that as much as 10 percent to 20 percent of the population may have active tuberculosis. In spite of this, there is no evidence that there have been many cases among US troops. Tuberculosis rates have not increased significantly, and, while a few cases have been diagnosed in returnees, the Army's program of detection picks up cases and those in whom the tuberculin skin test has converted to positive from a previously recorded negative reaction and places the individuals under treatment relatively rapidly. This program will soon include tuberculin testing or roentgenograms or both, as appropriate, for every Army member on entry into active duty, when going overseas, on return from overseas, and at the time of hospitalization or physical examination.

Plague.—Plague is a serious problem among the Vietnamese. In 1967, more than 5,200 cases were reported and many others undoubtedly occurred. Local epidemics have occurred among Vietnamese living and working in close proximity to US troops, and exposure of American personnel is inevitable. In 1967, an epidemic broke out among Vietnamese at the large US port complex at Cam Ranh Bay, and at least 56 cases occurred. A cordon sanitaire was established, and US Army medical personnel administered some 30,000 injections of plague vaccine, mostly to Vietnamese. In addition, buildings, dwellings, and suspected rat harborages in a 45-square-mile area were dusted with dimpylate. The outbreak terminated abruptly, not, however, before one case had occurred in an American soldier. This individual, who was known to have received at least one plague immunization, recovered with treatment.

Only five cases of plague have been diagnosed in US military personnel, plus an additional case in an American civilian employee. Apparently, the Army immunization program, under which plague vaccine is administered every six months, and the rat and flea control programs in US compounds have been quite effective.

One of the five US military cases of plague occurred in a returnee. There was no transmission from this patient, or, as far as is known, from the other four. Cases in humans, however, are not the only means by which plague is carried from one country to another. Many ships and planes returning to the United States from Vietnam frequently carry equipment and various materials for repair or salvage. The armed forces and the PHS are aware of the fact that plague-infected rats and fleas could be brought into the United States in the cargoes of these ships and planes. Between 1900 and 1924, there were at least seven outbreaks of plague at seaports in the United States, twice at San Francisco and at New Orleans and once each at Seattle, Oakland (Calif), and Los Angeles. Since 1924, however, sylvatic plague has been the major factor in human cases in this country, the largest outbreak being six cases of bubonic plague among Navajos in New Mexico in 1965. Plague has occurred, however, in commensal rats, and was recognized in Tacoma, Wash, in 1942. It persisted for nearly three years without any cases in humans being reported. One instance has been reported in which a plague-infected rat was found on a ship which had returned to California from Vietnam. The ship had also touched in Okinawa, Japan, and Guam (written communication from Armed Forces Pest Control Board, Department of Defense, Washington, DC, April 30, 1968).

In order to prevent the importation of plague into the United States, the armed forces and the PHS have introduced stringent control measures, both in Vietnam and at US ports of entry. All returning equipment and containers are required to be thoroughly cleaned before leaving Vietnam. In addition, vans and containers are dusted with 2 percent dimpylate (Diazinon) for insect control, and diphacinone-2-diphenylacetyl-1, 3-indandione in paraffin (Eaton's "Sewer Rat" Bait Blocks with Diphacin, or De-Pester Rat-Trol Concentrate) is placed within for rodent control. A long tape is attached to each block, and it is required that this tape extend outside the container for ready identification. Any container arriving at a US port of entry without evidence of proper insect and rodent control treatment is subjected to immediate quarantine.

While the importation of plague-infected rats and fleas from Vietnam will remain a threat, the program just described should prevent any large-scale outbreak from this source. Meanwhile, an occasional case of plague in a human being may be seen, most likely bubonic, but possibly pneumonic. Such cases will represent a diagnostic and perhaps a therapeutic problem for the individual physician, but should not give rise to a significant public health problem.

Cholera.—Cholera has been widespread among the Vietnamese, with more than 7,000 cases reported in 1966 and 6,000 in 1967. There has not been a single identified case in US personnel. This may be attributed to one or more of several factors, including immunization, protection of water and food, and state of nutrition. The important point is that the importation of cholera is not occurring and is not likely to occur.

Japanese B Encephalitis.—Unlike cholera, Japanese B encephalitis has been reported in US personnel. The number of cases has been small, however, and no cases have been reported in returnees. The fact that this disease has never been reported to have been acquired in the United States, plus the fact that the incidence in US troops during the Korean conflict was as high as or higher than that in troops in Vietnam without subsequent introduction into this country, justifies placing it very low on the list of possible public health problems attributable to returnees.

Filariasis.—Filariasis has likewise occurred in small numbers of US troops in Vietnam but has been recognized only by laboratory findings; no clinical cases have been reported. The disease will almost certainly not become reestablished in this country, primarily because of the relatively small reservoir of infection. Far more individuals with this disease returned to the United States from Asia and the South Pacific during World War II without the development of endemicity.

Helminthiasis.—Among the most significant of the helminths are hookworms. Localized outbreaks of hookworm infestation have occurred in troops who bathed in streams near villages. In one survey of returned combat troops, 14 percent had hookworm ova in their stools. This survey is not necessarily representative of returnees in general. In any event, the findings would only be of public health significance in this country if indiscriminate defecation and bare feet became a way of life. (There appear to be certain fringe elements of our society moving in this direction.)

Leptospirosis.—Leptospirosis is present in Vietnam and has occurred in small numbers of US personnel. It has not been reported among returnees. However, this disease is not commonly diagnosed, frequently being mistaken for influenza, dengue, or some other febrile infection. Some leptospirosis has undoubtedly been brought from Vietnam, but as the disease has been present in this country for many years, albeit infrequently diagnosed, the minor contribution by Vietnam returnees can be disregarded as a public health problem.

Melioidosis.—Melioidosis, which has also occurred in low frequency, is more interesting and, to date, more important than leptospirosis, not because it appears to represent more of a public health threat, but because it has two characteristics that represent a particular problem and challenge to the attending physician. First, the fulminating variety carries a high mortality. Early diagnosis, which is not difficult if the physician thinks of the condition, and treatment with massive doses of antibiotics are necessary. The second important characteristic of the disease is the long dormant period which has been reported to have occurred in some cases. The latter characteristic has led to the use of the phrase "medical time bomb" in the news media. Unfortunately, this is a term with sinister connotations.

Melioidosis has been diagnosed in 72 US Army personnel since 1965, ten cases in returnees from Vietnam and the other 62 cases in Vietnam. There have been 14 deaths among the 72 patients. Person-to-person transmission has not been reported and, until more is known about the epidemiology of the disease, it is impossible to speculate scientifically about it as a potential public health problem. There

does not seem to be much likelihood that this will occur.

Current Disease Problems In US Personnel

Certain groups of diseases, from the standpoint of incidence and loss of time, have been a relatively serious problem among US Army troops in Vietnam. As in almost every conflict in history, more soldiers are being hospitalized for disease in Vietnam than because of hostile action. In fact, for every combat casualty there are two or three casualties caused by disease.

Our greatest loss of manpower in Vietnam is attributable to respiratory, enteric, skin, and insect-borne disease. Venereal disease, although not important from the standpoint of hospitalization and lost time, also occurs in significant numbers and incites corresponding interest.

Respiratory Tract Disease.—There is nothing different or peculiar about respiratory tract diseases in Vietnam. Reliable data and statistics regarding incidence in the civilian population are not available, but references and US military medical personnel refer to upper-respiratory tract disease, bronchitis, and pneumonia as being present. Rates in US troops in Vietnam are significant, although much lower than in troops in the United States. Indeed, we may be carrying more respiratory tract disease to Vietnam than we are bringing back. Unless history repeats itself and another respiratory tract disease virus mutates in Asia, as happened in 1957 (and now appears to have occurred in the form of A2/Hong Kong/68), it is unlikely that respiratory tract disease will be recognized as originating in Vietnam, even if it occurs.

Diarrheal Disease.—United States troops experience a relatively high incidence of diarrheal disease in Vietnam, a country in which sanitation is somewhat less than perfect. The incidence is considerably higher than among troops in the United States (Table).

Incidence of Selected Diseases Among Active-Duty Army Personnel in the Zone of the Interior* and Vietnam, 1967†

	Zone of Interior	Vietnam
Common respiratory tract disease and influenza	124.6	33.3
Diarrheal disease	14.9	48.4
Skin disease	7.7	28.2
Fever of undetermined origin‡	14.6	75.3
Malaria	3.8	30.6

*United States.
†Cases per 1,000, average strength per year.
‡Data provisional.

In addition to ill-defined, albeit clearly manifest, diarrheal disease, cases of both amebic and bacillary dysentery, typhoid, paratyphoid, and infectious hepatitis have been observed in US troops in Vietnam. None of the specific infections have occurred in alarming numbers, although severe local outbreaks have occurred in some units. Ninety percent of the enteric disease is represented by a diarrhea of relatively short duration which remains unidentified but is probably of viral origin.

The presumably short incubation period and the short duration of most of these diseases, except, of course, infectious hepatitis, undoubtedly limit the number of cases in personnel arriving in the United States. Some hepatitis does return, as do some amebic and bacillary dysentery and salmonellosis. *Salmonella typhosa* has been reported to have been isolated from the blood of at least two returnees. The relatively small number of these cases and the generally high levels of sanitation and hygiene in the United States make it extremely unlikely that Vietnam returnees represent any significant public health threat in other than strictly the local sense.

Skin Disease.—Skin disease in US Army personnel in Vietnam is a serious problem from the standpoint of total incidence (Table). The hot, humid, unsanitary environment in Vietnam, combined with the difficulties of maintaining good personal hygiene, particularly during combat, leads to a variety of skin infections. Many of these infections are of mixed causation, but most are not serious and respond rapidly to treatment. Because skin disease is relatively obvious, it is almost always under treatment before the soldier returns from Vietnam. This fact, plus the relatively low epidemic potential of most of these diseases, makes it unlikely that they need be considered a potential public health problem in the United States.

Venereal Disease.—Vietnam has no monopoly on venereal disease. The exact incidence is not known, although syphilis, gonorrhea, chancroid, granuloma inguinale, and lymphogranuloma venereum have been identified. The incidence in US troops in Vietnam is higher than in the United States but lower than at other times in other parts of the world. Most of the cases in US personnel are gonorrheal and are under treatment prior to departure from Vietnam. In fact, personnel are generally so busy getting ready to depart during their last two weeks in that country that only the most industrious find time to contract venereal disease. Decreased sensitivity to penicillin on the part of the gonococcus is present in Vietnam,

as it is almost everywhere. Unfortunately, some reports in news media have alluded to gonorrhea originating in Vietnam as a menacing new Oriental venereal disease. Although some reports have indicated that there may be somewhat greater resistance, there is nothing new or particularly menacing about it. The relatively few cases in returnees are brought under treatment rapidly, and their effect upon the general venereal disease situation in this country is insignificant.

Insect-Borne Diseases.—A small number of cases of dengue, scrub typhus, and a viral disease with the delightful name of Chikungunya fever have been reported in US troops in Vietnam. There is evidence, however, that the incidence of these infections is higher than reported, as troops in Vietnam experience a relatively high rate for fevers of undetermined origin (Table).

Dengue.—Dengue and Chikungunya fever, which are similar clinically, can be disregarded as public health problems with respect to Vietnam returnees. Because of the short incubation period and duration of these diseases, it would probably require simultaneous shipment of a considerable number of infected men to an *Aedes aegypti* area to provide enough fuel to start an epidemic. This is a remote possibility. When dengue was rampant in the Caribbean in recent years, it failed to gain a foothold in the United States in spite of a thriving tourist traffic. No cases were reported in the United States in 1967.

Scrub Typhus.—Three cases of scrub typhus have been identified in returnees from Vietnam, one each in 1966, 1967, and 1968. It is extremely unlikely that this disease will become endemic in the United States, because of both the few cases in returnees and the ecological factors which have limited the geographical distribution of the disease in the past.

Malaria.—The main concern relative to insect-borne diseases is malaria. This is a serious problem in US forces in Vietnam (Table), and it is the most serious problem in returnees.

Malaria is being brought back from Vietnam in spite of intensive control efforts. In 1967, about 2,700 cases were diagnosed among returnees, many subsequent to discharge from the service. In one study, 4 percent of 2,500 returnees had malaria. This group represented high-risk personnel from combat units and is not representative of all returnees, many of whom have relatively little exposure to malaria while in Vietnam.

Of course, 2,700 cases of malaria in the United States is an impressive figure compared with the incidence just prior to the Vietnam conflict. Scattered among 200 million people over a year's time, however, a total of 2,700 cases is insignificant. More malaria was brought into the United States during the Korean conflict—over 20,000 cases occurred from 1950 through 1953.

In comparing the Korean and Vietnam situations, it is interesting to note that during the former conflict more malaria occurred in returnees than in personnel in Korea, while the reverse is true with respect to the malaria contracted in Vietnam. This is undoubtedly a reflection of the fact that the Korean variety was almost entirely vivax malaria and the greatest percentage of the Vietnam type is falciparum malaria. Vivax malaria is less severe clinically and is more likely to remain undiagnosed and recur months later, while falciparum malaria is generally diagnosed and treated early because of its severity. Falciparum malaria is also much less likely to recur.

For the reasons just stated, in spite of the predominance of falciparum malaria in Vietnam, the vast majority of the malaria cases in Vietnam returnees are vivax infections, approximately 85 percent to date.

The occurrence of vivax malaria, in the absence of known resistance to chloroquine phosphate and primaquine phosphate, indicates that the control program is not as successful as it might be. The program includes the weekly administration of a chloroquine-primaquine tablet and the use of insect repellents, bed nets, and protective clothing. Some troops forget these measures, particularly in the heat of combat, while others will not comply unless forced to do so. In this regard, it should be pointed out that in a combat situation it is difficult to motivate some individuals to use special measures to avoid an illness the occurrence of which insures removal from combat for a period of time and which carries a much lower chance of death.

In Vietnam, the US Army carries out constant and intensive supervision in an attempt to achieve the highest degree of malaria prevention. This is not easy under combat conditions and, before criticizing the individual soldier who fails to carry out malaria-control measures, one should remember the vast numbers of people in the United States who continue to smoke cigarettes and who fail to buckle seat belts in spite of the known hazards involved.

The malaria-prevention program requires that the administration of the weekly chloroquine-primaquine tablet continue for eight weeks after the soldier leaves the malarious area. It is frequently at this

point that the control program breaks down. When the soldier is rotated back to the United States, usually by air, he is either released from service or almost immediately departs on leave for a month or more. In the excitement and confusion of returning home, the chloroquine-primaquine tablets are frequently forgotten and, of course, supervision is impossible. The only alternative would be to retain every returnee for a period of two weeks while primaquine is administered daily to achieve eradication of malaria. Such a program would entail considerable logistical and administrative difficulties.

The important question for the medical profession and public health personnel is whether malaria will again become endemic in the United States as a result of the introduction of cases from Vietnam. Given the opportunity, malaria is ever ready to return. Ceylon, a country which had nearly eradicated the disease a few years ago, is now experiencing a full-blown epidemic. To date, only a handful of vivax malaria transmissions in the United States are considered attributable to Vietnam returnees. There has not been an outbreak of the magnitude of the 35 cases which occurred in a group of Camp Fire Girls in California in 1952 to 1953. The outbreak was believed to have originated with a veteran of the Korean conflict. In spite of this and other smaller outbreaks, malaria did not become reestablished in the United States during or after the Korean conflict.

Much publicity has been given to drug-resistant falciparum malaria, and there is apprehension that it might be introduced into the United States from Vietnam. Some cases have occurred in returnees although, as has been pointed out, these represent only a very small percentage of the total introduced malaria in previous times. (Introduced malaria is "malaria that is due to the local transmission of an infection from cases brought into the area from outside its geographical or epidemiological limits.") Falciparum malaria was at one time endemic in the southern United States and it was occasionally introduced into the North. For example, in 1898, a company of National Guardsmen returned from duty in the South and promptly set off an epidemic of falciparum malaria in Connecticut.

The situation is entirely different today. Reasonably good prevention of resistant falciparum malaria is being achieved with daily administration of dapsone along with the weekly administration of chloroquine-primaquine tablets in selected high-risk personnel in Vietnam. Treatment with quinine, pyrimethamine and dapsone has also proved satisfactory, reducing greatly the number of cases that might be brought back from Vietnam.

Personnel are not being returned from Vietnam in units, as was the case with the guardsmen from Connecticut. Instead, troops are being individually replaced and brought back in groups which disperse upon arrival in this country. This system precludes the arrival of a large number of infected individuals in the same place at the same time.

Returnees who do have malaria are almost always rapidly given effective therapy, sharply reducing the time during which they could serve as a reservoir for the disease.

An additional major change in the situation today is that the environment in the United States is no longer as receptive to malaria. Unlike Ceylon, where the control of malaria had been almost entirely brought about by a program of eradication, much of the decline in the United States was effected by environmental changes which were not directed specifically at malaria or mosquito control. Introduced into North America from Europe and western Africa, malaria was widespread in the United States by 1850. The impoundment of water for mills, and later for public water supplies in large towns, contributed to the widespread breeding of mosquitoes. The absence of screening in the dwellings of the still predominantly rural population permitted the mosquito easy access to people, both infected and noninfected.

With industrialization and urbanization, malaria began to retreat and, by 1875, was already on the decrease in the North. In the early years of the 20th century, drainage, oiling, screening, and the mass use of quinine were undertaken, forcing a further retreat of malaria, primarily into the South. Control measures in this region were intensified by the Army and the PHS during World War I.

In the early 1920's Paris green was introduced as a larvicide. Louis L. Williams, MD, developed a model plan for statewide malaria control in 1937, and in the 1940's chlorophenothane (DDT) was introduced on a nationwide scale.

The result of all the aforementioned measures was that contact between man and the mosquito was reduced and the malaria reservoir eliminated.

Even the curse of recent years, stream pollution, has played a role in the eradication of malaria in the United States. Not too many years ago, an eminent malariologist made the following statement which might be considered amusing in the light of subse-

quent events: "Malariologists should be alert for opportunities to cheapen control by using industrial, agricultural, or home waste to pollute breeding places."

Just imagine anyone making that recommendation today!

It is not meant to imply that conditions now are such that it is impossible to establish endemic malaria in the United States. The mosquitoes and the climate that once maintained vivax malaria throughout most of the country and falciparum malaria across the southern tier of states are still present. However, for malaria to become endemic, there are several conditions which must be satisfied. There must be a large enough reservoir of people with parasitemia. There must be adequate numbers of the right kind of mosquitoes and these mosquitoes must have relatively free access to the reservoir and to the susceptibles. In the United States, the only one of these conditions that exists today is adequate numbers of the right kind of mosquitoes—and some may even question the adequacy of the numbers.

The reservoir is simply too small, and adequate treatment causes it to remain small. This fact, combined with the current relatively limited access of mosquitoes to people as compared with times past, will limit the occurrence of introduced malaria to sporadic cases and perhaps an occasional localized, circumscribed outbreak. It is extremely unlikely that malaria will become a major public health problem in the United States as a result of introduction of the disease by military returnees from Vietnam.

Comment

It is unlikely that any infectious disease known to be present in Vietnam today will become a major public health problem in the United States under present conditions. Such an eventuality is possible but highly improbable. Public health and medical personnel in general should, nonetheless, be aware of the fact that any given returnee from Vietnam may harbor any one of a variety of diseases which may be transmitted to other individuals. A careful history-taking and a high index of suspicion will protect against the transmission of disease from these patients.

The armed forces are exerting every effort to prevent disease and, in the event of its occurrence, to treat it and prevent further transmission. In this regard, the closest coordination is effected with the PHS and all other agencies, national, state, and local, which share the common interest. The record to date is excellent, and there is every reason to believe that it will remain so.

Generic and Trade Names of Drugs

Pyrimethamine—*Daraprim.*
Chloroquine phosphate—*Aralen Phosphate.*

(The references may be seen in the original article.)

EMERGENCY TREATMENT OF SEVERE BACTERIAL INFECTION

Frank P. Foster, MD, Med Clin N Amer 53(2):437-447, March 1969.

Successful treatment of emergency infections demands a skill that every practitioner will need at some time, regardless of his field. It is hoped that these principles and examples will be of service to those facing infections that threaten life, demand instant treatment, and often appear unexpectedly.

The special challenge of emergency situations is the lack of time for exact identification of the responsible organism, so that start of treatment must be based first on clinical judgment. The ideal is to combat the most likely invader before catastrophe becomes inevitable as the point of no return is passed. Prompt treatment can compensate in part for initial lack of exact identification, since it finds the body with the fewest bacteria and their equally important toxins (a patient can die quite "sterile"), rapidly multiplying invaders are in their most susceptible state for treatment, and the body is close to its defensive peak with the reticuloendothelial system, liver, and kidneys relatively undamaged.

Specific roles of each must receive special emphasis because (1) the reticuloendothelial system constitutes the body's basic defense mechanism against infection; (2) the intact liver supplements this and is the major detoxifier; and (3) the kidneys are the sole route of excretion for most of the antibiotics. Thus, with renal failure, excessive blood levels may result, which, in the case of the nephrotoxic agents kanamycin, colistin, and vancomycin, further increase kidney damage. The resulting

azotemia and toxin retention compound the problem further, constituting a self-feeding vicious circle which may end in complete failure.

This discussion is limited to infections with these three characteristics: (1) life is endangered; (2) immediate treatment is essential; and (3) some element of the unexpected often exists.

Principal causes for such infections can also be grouped under three headings: (1) inadequate host resistance; (2) special nature of bacterial invaders; and (3) anatomical factors. Combinations of two or more of these commonly occur to create our worst problems.

Inadequate Host Resistance

Nonspecific types of inadequate host resistance include extremes of age, malnutrition, cachexia of malignancy, diabetes, uremia, congestive heart disease, and shock.

Externally induced factors include severe burns, severe trauma, anticancer therapy by chemicals or radiation, corticosteroid therapy, immunosuppressive therapy, organ transplants, internal prostheses (especially for the heart), and many types of surgery that are the more dangerous as they are performed in closer relation to the thoracic diaphragm.

Established organ damage is seen in bronchitis, bronchiectasis, emphysema, intestinal obstruction (partial or complete), prostatic obstruction, defects in blood-forming organs, and inadequate production of immune globulins.

Special Nature of Bacterial Invaders

In the United States today just over a half dozen kinds of bacteria cause the worst infections and most of the deaths not caused by a virus, yeast, rickettsia, or plasmodium. The penicillin-resistant staphylococcus probably remains the most important individual killer, but is now closely followed by the increasingly predominant Escherichia coli, followed in turn by the common gram-negative bacteria—more or less normal inhabitants of the body—enterobacter (Aerobacter), Proteus of two types (indole positive and negative), and Pseudomonas. Together they cause some 90 percent of our deadly infections. The Haemophilus influenzae, enterococcus, pneumococcus, and bacteroides in diminishing degree make up most of the remainder, with the important exception of the tubercle bacillus. The basis for the relatively new-found competence of these organisms, which for many years have been fairly "tame," is the result in part at least of today's use of antibiotics.

Anatomical Factors

The best example of an anatomical factor is the rigid covering of the central nervous system, which permits almost immediate compromise of function of vital centers from even modest inflammatory reaction and its resultant increased intrasystem pressure. As proof of this, two thirds of the deaths from meningococcic meningitis will occur within a few hours of the onset, and 20 percent of those caused by the pneumococcus occur within the first day. Infection with an acute effusion in the more elastic pericardium offers a less dramatic example of the same concept.

In interesting contrast, lack of a tight boundary is also a hazard, as found in the bloodstream, peritoneal cavity, genitourinary tract, or lungs, where heavy contamination results in seeding of an extensive area before it can be contained or walled off.

Choice of Drug

The antibiotic chosen must combat the invaders most likely to be successful in that particular situation and once started is given until an adverse clinical course requires change. The decision wisely starts with proper regard to factors influencing bacterial characteristics in that particular institution. For example, the bacteria predominant in a large general hospital caring for accidents, obstetrics, pediatrics, and so on, may differ considerably from those in a hospital specializing in orthopedic diseases or another where much cancer or diabetes is handled. Local styles in antibiotic treatment, whether strong on broad-spectrum agents, combinations such as penicillin and streptomycin, or some of the other common antibiotics such as Chloromycetin (chloramphenicol) or erythromycin, will produce their patterns of susceptible and resistant bacteria. The head of the laboratory will likely be the best authority to consult.

Clinical experience reminds us that genitourinary and gastrointestinal contaminants are largely gram-negative, while those from skin and respiratory areas are gram-positive; often this is enough information to start therapy.

For infections within the meninges, age is a most important determinant. E. coli predominate in the newborn, Haemophilus influenzae in children, and staphylococci after fractures; meningococcus is number one in an epidemic, and the pneumococcus is more common in persons over 50 years of age.

Patients with severe burns, uncontrolled diabetes, and recent operations on the heart are most often infected by the Pseudomonas and staphylococcus.

Staphylococcal bacteremia is not uncommon in the young, but is not as deadly as in later life, when it occurs most commonly in patients with hypertensive heart disease, diabetes with vascular faults, and leukemia.

In shock caused by infection, particularly if the onset is rapid, gram-negative bacteria are most suspect, with E. coli the leader. It is important to emphasize that shock from any cause facilitates infection by diminished tissue oxidation and nourishment plus the loss of efficiency in the reticuloendothelial system.

In foul-smelling and gassy wounds, especially those with considerable tissue destruction, anaerobes must be thought of first and their presence sought by special techniques that are rarely done routinely. Gram-negative bacteria also produce gas and must be remembered along with clostridia.

Many other clinical truisms are well known, such as the danger from even a small puncture wound, especially in a rural setting, or that of animal bites when there is a possibility of rabies.

Choice of Specific Antibiotic

In choosing antibiotics, some should be avoided in an emergency situation and three in common use require special emphasis.

Three Antibiotics to Avoid.

Broad-spectrum tetracyclines should not be used because they lack ideal killing power, may be toxic to liver and kidney, can cause diarrhea with possible critical loss of salts and water, permit superinfection, produce negative nitrogen balance in some cases, and may represent a special hazard to women in the last trimester of pregnancy. *Chloramphenicol* should not be used (unless there is no substitute) because of its toxicity to the blood-forming organs and to the liver when already damaged. Newer antibiotics, particularly ampicillin and synthetic penicillins, perform as well or better with little or no danger. *Streptomycin* is ototoxic and has but brief effectiveness against many organisms before resistance to it develops.

Antibiotics to Use

At the risk of being arbitrary and in full recognition of the fact that opinions differ widely, we use the following drugs on the basis of proved effectiveness.

Kanamycin is the drug of first choice for the most severe infections when invaders are unknown. Although toxic to ear and kidney, it is effective against most of the dangerous bacteria listed with the exception of Pseudomonas, Haemophilus influenzae, and anaerobes. Damage from it is rare if it is stopped within the first week when a proper substitute will often maintain the advantage gained. The maximum daily dosage is 2 gm. intravenously, divided into three or four doses.

Cephalothin (Keflin) often serves as an adequate substitute or backup for kanamycin, and its remarkably low toxicity even at high doses, such as 8 to 12 gm. per day, produces high blood levels with little danger. It is less effective against some gram-negative bacteria, especially Proteus other than mirabilis, but in general has a spectrum similar to kanamycin.

Penicillin G remains the basic antibiotic against most gram-positive organisms with the important and well-known exception of the penicillin-resistant staphylococcus. When given in doses of 30 to 60 million units, penicillin is effective against a number of the gram-negative bacteria except Pseudomonas and nonmirabilis Proteus. In these doses its toxic effects, especially in the elderly, may produce epileptic attacks or hyperkalemia if the potassium salt is used.

Vancomycin is our most reliable single agent against penicillin-resistant staphylococci, and its value happily extends over much of the rest of the gram-positive spectrum as does that of penicillin. Damage to the vein, ear, and kidney has prevented its wide use; as a consequence we have yet to encounter strains of staphylococci resistant to it. It is given intravenously in doses up to 2 gm. a day. To limit local damage it is given quickly at 6 or 8-hour intervals piggyback through an already established infusion and is best dissolved in 200 or 300 ml. of saline for this purpose. Its toxic effects are rare when used for less than a week.

Synthetic penicillins—two types of synthetic penicillins exist.

1. *Oxacillin, methicillin, nafcillin, cloxacillin, and dicloxacillin* are now available and are all generally effective against penicillin-resistant staphylococci. Rarely, irritation of the kidney occurs, and superinfections are reported after their use. In recent months staphylococci resistant to them have appeared in various parts of the world to compromise their future value to some extent. These forms of penicillin are

definitely less active than the parent against other organisms. They should be held in strict reserve for the specific purpose of combating resistant staphylococci. Doses tend to be large, and package data should be consulted for each.

2. *Ampicillin*, we believe, is the most valuable of the newer antibiotics, being effective against gram-negative invaders (except for Pseudomonas and Proteus other than mirabilis) in modest doses. Its special virtue is activity against some anaerobes, the enterococcus, Haemophilus influenzae, and salmonella group. It is essential to re-emphasize that while it is a new synthetic penicillin, it has no activity against penicillin-resistant staphylococci. Doses vary from 2 to 6 gm. by intravenous injection or orally.

Colistin, successor to polymyxin, is the sole reliable agent for Pseudomonas; the dose is up to 5 mg. per kg. of body weight per day. Fortunately it is also quite active against other gram-negative organisms, save for Proteus.

General Principles of Treatment

It is urged first that we make use of the concept that the "invader," not the "disease," must be the primary target for emergency treatment of severe infections. This means that it is prudent to discard time-honored terms such as meningitis, peritonitis, pneumonia, and so on, unless each is coupled with the known or a presumed causative agent. For example, while penicillin is the established conventional drug for "pneumonia," it is of absolutely no value for pneumonia from a resistant staphylococcus, when vancomycin or synthetic penicillin must be prescribed.

Second, all antibiotics listed for emergency treatment of severe infections are given intravenously in maximum doses at the start.

Third, therapy begins immediately after a suitable search is started for the invader by smear and culture. When stained smears do not give an immediate diagnosis, treatment is never delayed for the results of cultures.

Fourth, initial therapy is maintained so long as clinical response is good. Laboratory reports showing conflicting sensitivities should not countermand treatment that is obviously successful. Change in treatment is made only when the infection is not responsive to the selected agent, at which time culture results should be highly important in the new choice.

Fifth, danger to life from a severe infection far outweighs the danger of any therapy listed when reasonable care is exercised in its administration.

Treatment of Specific Conditions

Superinfection. Invasion by one or more new organisms during treatment for the original infection is a hazard of all antibiotics, particularly the broad-spectrum group, some of the synthetic penicillins, and occasionally penicillin itself. Such processes may be subtle and hard to discover, save by the patient's failure to gain; others may produce moderate symptoms such as the sore mouth and itching of a Monilia infection, or they appear at times as the highly dramatic type with chills, pain, fever, shock, and diarrhea such as results from staphylococcal superinvasion. Drug reactions (often to the antibiotic itself), embolism, and myocardial infarction are important differential diagnoses to consider in the latter instance.

Treatment for a superinfection has but two simple rules: (1) stop the current antibiotic treatment at once, and (2) select and immediately give a new agent that is effective against both the original infection and the presumed new one. An advantage of the useful antibiotics listed above is that superinfection occurs rarely except in the penicillin group.

Peritonitis. No body area provides potential for a more complex mixture of bacterial invaders than the peritoneum. After perforation or severe compromise of the integrity of the bowel wall, the common gram-negative bacteria, enterococci, anaerobes, and, if the patient has been receiving treatment in the hospital for a while, resistant staphylococci, may all be present.

Kanamycin and ampicillin administered simultaneously represent the best combination in our experience, and they are used unless the clinical course proves the need for change. Lack of response after 2 or 3 days of this treatment raises the question whether the Pseudomonas or a staphylococcus resistant to kanamycin may not be present. Substitution of colistin for ampicillin should not only take care of the Pseudomonas, but will strongly support the activity of kanamycin against the other gram-negative bacteria.

With these two nephrotoxic agents it is most important that the urine output be carefully monitored and adequate fluids be given to support as close to 1 liter of urine output daily as possible. If no response is seen several days after this change, vancomycin is substituted for kanamycin to combat more resistant staphylococci if present. Continuing failure to respond strongly implies the presence of a leak or foreign body, or formation of an abscess, which requires surgical management at once.

Shock. Shock and death from bacterial infection may resemble myocardial infarction clinically and approach it in frequency in many general hospitals. The majority result from gram-negative infections, but enough come from staphylococci, streptococci, clostridia, and others that concentration on treatment for the gram-negative group alone is not prudent. The basic pathophysiologic event of shock is circulatory failure in the capillary loop by final arteriolar paralysis with persisting spasm in the venule, permitting tissue anoxia, acidosis, and failure of the reticuloendothelial system function, along with anuria, coma, heart failure, and death. Damage to the vessel walls by circulating gram-negative toxin is the classical cause of shock underlying its common occurrence after urinary, intestinal, gallbladder, and gynecological manipulation or operation. Bacteremia is not necessary. Shock is more common and relentless in cirrhotics, diabetics, patients on anticancer therapy, or those burned, with resultant death rates that may vary between 40 and 80 percent.

Proper treatment requires elimination of the causative infection by the best antibiotic and coincident keeping the patient alive long enough by combating the various sequential events of circulatory collapse. Fluid replacement, oxygen, proper airway, avoidance of depressing drugs (particularly during the excitement phase), correction of acidosis, cautious use of blood pressure supporting agents (isoproterenol seems best when other measures fail), digitalization, and, if no improvement follows, massive steroid therapy are justified well before final collapse. Dibenzyline as a relaxant for the venous part of the capillary loop has been recently recommended and may well win a place, although this is still being investigated.

Anti-infection therapy is provided by the combined protection of kanamycin, colistin, and ampicillin. When urine output is adequate, this is given for 3 to 5 successive days; then, if response warrants, colistin is dropped unless Pseudomonas has been cultured. When anuria is present at the start, therapy is given twice at 3-day intervals, and the situation must then be completely re-evaluated and modified in accordance with any available guidance by culture. Continuing anuria when the bacteria require the drugs mentioned still permits their continued use in roughly one-quarter or one-third doses.

Meningitis. Meningitis is relatively rare and always an emergency; few diseases kill faster or on many occasions show fewer diagnostic features. Headaches, stiff neck, fever, nausea, vomiting, and variable neurologic signs will consistently prompt performance of the spinal tap to give the patient and the doctor a fighting chance.

Too often, however, especially in the very young, elderly, or debilitated, meningitis may manifest itself by little more than grippe-like symptoms with some nausea and confusion. Diagnostic tap is all too rarely done before the patient is unconscious. Convulsions or gross neurologic changes may then herald what is soon a terminal event, either rupture of an abscess or establishment of advanced cerebritis.

In most cases ampicillin is the drug of first choice, and always for the E. coli infection of infancy and Haemophilus influenzae infection of childhood. The same drug is an adequate starter for the pneumococcus and meningococcus of the epidemic, although for these, regular penicillin is the preferred agent. When infection results from the staphylococcus, ampicillin is totally worthless and special efforts must be made to rule out this invader early if ampicillin is used. Vancomycin followed by a synthetic penicillin is appropriate for the staphylococcus, and both are given in full doses.

Effectiveness of the chosen antibiotic is commonly first seen in the patient's clinical response through better contact, sense of well-being, less headache, and fewer abnormal neurologic signs. Spinal fluid changes and the febrile course may lag by some days, so that the proper duration of treatment is hard to judge. When clinical improvement is well established treatment can usually be continued by oral administration, unless vancomycin and cephalothin are needed.

It should be stressed that the laboratory personnel must be instructed to check for the tubercle bacillus as well as the ordinary pathogens. While not common, tuberculous meningitis can attack in very active form and special measures for its control are needed. A second warning is the danger inherent in lethargic patients, when only vague symptoms indicate what may be a dangerous ongoing process. Formation of an abscess in a relatively quiet part of the brain is a special problem, and its possibility should be anticipated by checking for neurologic changes or variation in spinal fluid findings.

Preoccupation with antibiotics should never prevent the most careful attention to maintenance of proper airway, prevention of aspiration, tracheostomy when essential, maintenance of appropriate fluid balance without overhydration with its increased brain edema, and just enough medication to

prevent convulsive seizures without depression of vital centers.

Bacterial Endocarditis. Unless valve destruction occurs early, bacterial endocarditis is not an emergency infection in the sense that death often comes within hours or a few days. Nonetheless, the end result is very directly related to the period of time between establishment of the infection and initiation of the treatment. When therapy is started within the first 2 weeks the cure rate is high and secondary damage unusual; from 2 to 6 weeks the cure rate may drop to 50 percent or less with much secondary damage. After 6 weeks of the disease most patients are eventually lost; if they are cured of the infection, crippling heart or kidney disease often follows.

Precisely why a rather mild invader such as Streptococcus viridans engrafted on a valve lesion that may be 25 years old produces a disease that has been nearly 100 percent fatal is unknown. The gravity of the situation has increased rapidly, because Streptococcus viridans is on the decrease and the staphylococcus, gram-negative group, and a variety of unusual organisms take its place. An added danger is that attention is so often guided primarily to the infection when the coincident damages from nephritis, myocarditis, embolization, and valve destruction are of such great importance. Reasons for the special vulnerability of the valve appear to lie in its poor blood supply (though it lives and works within the bloodstream), plus the fact it is almost never at rest, being traumatized with each heartbeat. This encourages local fibrin buildup, burying the invading organism deeper each day, a major cause for the prolonged therapy required after a late start.

Before treatment, every possible effort to determine the precise invader must be made using both aerobic and anaerobic cultures. Several must be drawn daily for 2 or 3 days with no required time relation to chills or temperature elevation, and treatment is started when clinical evidence for endocarditis is adequate. Unexplained fever for 10 to 14 days in the presence of a heart murmur is considered to be due to bacterial endocarditis until this hypothesis is disproved. Treatment by penicillin and streptomycin must be given, with doses of penicillin G, 20 million units, and of streptomycin, 2 gm. in four to six divided doses, at the start.

When treatment is correct, response is both prompt and sustained, shown by improvement in the patient's sense of well-being, reduction in fever, and disappearance of other manifestations. Failure to respond within 4 days suggests incorrect diagnosis or a resistant staphylococcus, an unresponsive gram-negative invader, or one of the rarer organisms, which must be identified by culture or eliminated through manipulation of therapy.

Improvement following a shift to vancomycin will usually indicate a resistant staphylococcus. After the first week trial of cephalothin or a synthetic penicillin may be substituted if the response is sustained.

Failure after shifting to vancomycin justifies giving colistin to check tor Pseudomonas or later kanamycin if a nonmirabilis Proteus is present. The enterococcus may show some response to the penicillin-streptomycin therapy. The same may be true of certain anaerobes, but ampicillin in full doses for several weeks is preferred in these cases. So complicated a sequence of therapy is rarely required, since 70 to 90 percent of cultures will eventually be positive, but a scheme to approach exceptional cases must be kept in mind.

Burns. Patients who die after surviving the immediate effect of severe burns most commonly do so as a result of infection. Balance between increasing bacterial growth with body invasion opposed by failing defenses over a period of days tips the scale against the patient unless the infection is sought and checked. The past several years have seen brilliant innovations in burn treatment, with the introduction first of silver nitrate and later of mafenide (Sulfamylon), which have markedly increased the survival rate. In spite of this, bacteremia, usually with Pseudomonas or staphylococcus, remains the most serious of later threats. A silver-sulfadiazine complex recently described by Fox appears to have advantages over either silver nitrate or Sulfamylon, and progress with this should be thoughtfully watched.

The complicating systemic infections have been managed largely by colistin or a synthetic penicillin, though parenteral Garamycin, not yet available in the United States, may be preferable to colistin, according to current studies. Its disadvantage is that it may produce vestibular irritation. A valuable summary of the problem is available.

Genitourinary Infections. While genitourinary infections are rarely immediately lethal, an emergency element exists because once established they can cause crippling or deadly kidney damage. Unfortunately the genitourinary tract in both men and women is so constructed as to encourage establishment and persistence of infection, since it contains an almost perfect culture medium from cortex to ex-

ternal meatus closely associated anatomically with an endless source of invasive bacteria from the intestine and perineum. Like the nervous system, it is also characterized by a series of easily occluded pools.

Potential for such blocking is high, whether from pregnancy and delivery, repeated trauma of intercourse, the prostate gland, stones, strictures, and tumors. To the physician's real advantage, true urgency for treatment (that is, within hours or a day or so) rarely exists, permitting more careful identification of the responsible bacteria with appropriate identification of the drug best fitted to eliminate them. Before this can be permanently successful, discovery and disposal of all obstructive lesions must be accomplished. If not personally competent, the physician in charge should seek the help of a trained urologist, during which interval treatment for the infection must proceed vigorously.

Both patients and physicians are promptly responsive to acute infections with their onset by chills, fever, dysuria, and frequency. However, both are too prone to be satisfied with the symptomatic control that comes from one of many antimicrobials before all invaders are completely eliminated, and consequently treatment is stopped too soon.

It is our feeling that for the acute infection, treatment for a minimum of 2 weeks by the most highly effective drug should be carried out, with cultures done several times during the treatment period to be certain the effect is more than suppressive. Drug selection is by principles already mentioned and results are better when the first drug is supplemented by additional treatment with a bacterial suppressor such as methenamine for several weeks more.

Bacteremia. Patients most prone to bacteremia are precisely those already listed as susceptible to the worst invaders, and death rates of well over 50 percent are not uncommon. Lacking a specific target organ for clinical reference, bacteremia can exist for a considerable period of time before it is identified. The high mortality from bacteremia from any cause is related to this resulting lag in starting effective treatment, permitting saturation of body defenses by unchecked bacterial growth.

In no clinical situation is the popular tendency to "use a broad-spectrum antibiotic when in doubt" more certain to produce mischief. Too often tetracyclines give an apparent response by their partial control, since bacterial growth is slowed but not stopped, only to break through again with greater energy. The interval will have partly exhausted the body's defenses, eliminated sensitive bacteria, and encouraged superinfection.

Choice of the proper antimicrobial is made on every scrap of perceivable evidence, and unless an acceptable lead exists, the combination of kanamycin, ampicillin, and colistin is fully justified, starting with full intravenous doses of each. After several days of good response, first the colistin, then either kanamycin or ampicillin, is dropped, depending on one's judgment, allowing at least 4 days between each change to evaluate the effect. The return of any evidence of bacteremia requires immediate resumption of the last antibiotic discontinued, and the effective spectrum of that drug has now helped to identify the invader.

Staphylococci, because of their special power for localization and abscess formation, and their extraordinary capacity to lie dormant and then reinfect as in osteomyelitis, are particularly to be feared. It must be emphasized that, contrary to what might be expected from so lethal an invader, the onset and early course of staphylococcal infections are neither hectic nor dramatic in many cases. Repeat cultures during and after treatment are mandatory. Oral administration of an effective synthetic penicillin is prudent for 10 to 14 days after the active infection is over. Dicloxacillin is useful because of its adequate blood level with modest doses.

It should be restated that bacteriologic investigation is not complete unless cultures are ordered for anaerobic as well as aerobic organisms, the incidence of the former running up to 10 percent in some series. As in bacterial endocarditis, cultures should be obtained several times daily with no reference to clinical manifestations such as malaise, chills, sweats, or fever.

Comment

Continuing advances in medical science can only create more and more situations that demand emergency treatment for serious infections. A growing population at risk by infection will come from more old people, bolder surgery, wider use of defense-suppressing agents, continuing trauma on highways and in the air, and more and more invaders resistant to the antibiotics until some new type of antimicrobial agent is found. It follows that until we have a universal antimicrobial that will surely spare the host and spoil the invaders, we must use the available agents with a skill that compensates for their deficiencies.

Success in treatment is based on factors identified above, and the situation is summarized by the statement that the best answer to our needs is not a new antibiotic but a physician fully alert to the possibilities of an emergency situation and immediately responsive to them through wise use of the drugs we now have.

(The references may be seen in the original article.)

APPRAISAL OF THE TRAUMATIZED ABDOMEN

Thomas V. Berne, MD and Ernest H. Shore, MD**,*
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During the last decade on the surgical services of the University of Southern California there has been a gradual change in policy regarding routine operative exploration of patients with most varieties of abdominal trauma. The previous policy of very early operation with little diagnostic study has been replaced by one of appropriate study of most such patients, utilizing contemporary developments in diagnostic methodology. A major stimulus to this altered approach was the increasing frequency of the simultaneous arrival of groups of seriously traumatized patients on our emergency services. This has frequently demanded a selective approach to their management. From such experience it became obvious that many patients with abdominal trauma could be studied in this way and operation frequently avoided with safety. Further impetus for such a policy developed when deaths occurred in patients undergoing exploratory celiotomy which revealed no hazardous intra-abdominal injury.

The basic principle of selective management is the attempt to make as precise a diagnosis as feasible. The methods employed are frequently repeated, meticulous, periodic examination for changing physical findings, integrated with appropriate use of laboratory and radiological studies. The widest application of these techniques has been in cases of stab wounds and blunt abdominal trauma. Alternatively, gunshot wounds are extremely treacherous and the probability of visceral injury is so great that almost routine celiotomy has been carried out for any such wound of, or near, the abdomen.

Bedside Examination

Physical examination usually provides the key information on which the decision for or against operative intervention is made. Some patients will have findings which obviously require immediate operation. Alternatively, many patients with stab wounds and blunt trauma may be safely observed if there is no evidence of progressive hypovolemia or chemical, bacterial, or enzymatic peritonitis. Usually the rupture of a hollow viscus leads to the rapid development of the classical triad of diffuse tenderness, diffuse rigidity, and absent peristalsis. The presence of hemoperitoneum is more difficult to detect. Initial abdominal findings are those of diffuse tenderness and active bowel sounds. Later, decreased peristalsis and occasionally rigidity may develop. The safety of continued observation relies heavily upon the frequently repeated periodic examination for changing findings.

Physical examination often discloses findings consonant with overt parietal injury. When findings exceed those explainable by the known injury, the likelihood of covert injury is great and celiotomy is indicated. Examples of predictable findings due to parietal injury are: tenderness in the muscle group at the site of a stab wound, the increase in abdominal tenderness induced by voluntary tensing of the musculature involved by abdominal wall contusion, and the diminution of bowel sounds in spinal or pelvic fractures with retroperitoneal bleeding.

Sustained hypoactivity or progressive diminution of bowel sounds is a highly reliable sign of hazardous intra-abdominal injury. Exceptions occur in patients who have received large doses of narcotics or who have suffered major extra-abdominal blood loss, as well as in some with pelvic and spinal fractures. Such patients may have decreased bowel sounds without serious intra-abdominal injury. When a patient with known abdominal wall contusion develops progressively diminishing bowel sounds or when rigidity accompanies the hypoactive peristalsis of retroperitoneal bleeding, these findings are not explainable by the known injury and demand celiotomy. Alterna-

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tively, when bowel sounds remain active, injury which demands immediate celiotomy is rarely present.

When tenderness of the ventral parietes is too extensive to be explained by the apparent injury, or when the area or degree of tenderness increases, peritonitis must be assumed to be present. Involuntary parietal rigidity may occur from abdominal wall injury and is usually localized to the region of the traumatized muscles. When such rigidity extends to untraumatized areas, or when a previously soft area becomes tense, this must be assumed to be due to peritoneal irritation.

The probing of stab wounds and calculation of missile paths by examination of entrance and exit gunshot wounds has frequently been misleading. Nonproximate signs of value in the detection of serious intra-abdominal injury are the peripheral findings indicative of compensated hypovolemia due to blood loss or the development of peritonitis. These signs may precede changes in hematocrit or blood pressure as indicators of intra-abdominal blood loss or fluid pooling. Such vasoconstrictive findings include rising cold-cool levels of the lower extremities, cordlike greater saphenous vein, oliguria, hypotension on sitting up, and diminishing tibial pulses.

Laboratory Aids

Hematocrit

The peripheral venous hematocrit is one of the most important laboratory tests available in the evaluation of the patient with a traumatized abdomen. A hematocrit should always be performed on blood obtained by venipuncture or removed from a centrally placed venous catheter. Finger pad puncture may not yield reliable results. Interpretation of the hematocrit is greatly enhanced by serial determinations. Documentation of a falling hematocrit is a reliable sign of a very recent or active blood loss. Such blood loss in the severely traumatized patient may have occurred from scalp lacerations, hemothorax, retroperitoneal injury, or skeletal fractures and greatly complicates the use of the hematocrit in the recognition of intra-abdominal bleeding. Numerous factors such as the magnitude and rapidity of blood loss, infusion of whole blood or intravenous fluids, and the time elapsed since injury all have effects on the resultant hematocrit. The clinician must assess the magnitude of each known source of blood loss and consider all these factors. If after such an evaluation the hematocrit falls below the predicted range, covert hemorrhage must be suspected.

Mechanisms productive of an elevated or rising hematocrit rarely occur as the result of extra-abdominal injuries. Notable exceptions include burns, mediastinitis, and aspiration pneumonitis, which are all readily detectable conditions. In their absence the development of hemoconcentration, in the observation period following trauma, is usually the result of the intra-abdominal sequestration of a plasma-like fluid and denotes a serious intraperitoneal injury with resultant chemical, enzymatic, or bacterial peritonitis. Concomitantly, the bedside evaluation of such cases may reveal the peripheral signs of compensated hypovolemia.

From the foregoing it is apparent that hazardous intra-abdominal injury is rarely associated with a stable hematocrit. When urinary output is maintained in a nonoliguric range by the intravenous administration of fluids calculated to supply hourly maintenance needs only, a "steady state" exists and significant hemorrhage or fluid sequestration is not occurring. Occasionally an injury may produce both hemorrhage with resultant hemodilution and peritonitis causing hemoconcentration. These effects balance each other, yielding a stable hematocrit while resulting in progressive hypovolemia. In this situation recognition of the signs of hypovolemia becomes critical. Additionally, in such cases the administration of maintenance volumes of intravenous fluids will not maintain urinary output indicating that hypovolemia exists.

Serum Amylase

Serum amylase should always be determined in cases of abdominal trauma. Elevated values may be observed in pancreatic rupture and gastric, duodenal, or enteric perforations. The finding of hyperamylasemia does not constitute an absolute indication for celiotomy because high values may be found with pancreatic trauma in which there is no gross pancreatic rupture. Hyperamylasemia is considered to be an absolute indication for a gastroduodenoenterogram employing water-soluble contrast media unless there are indications for immediate operation. This radiological procedure has been of particular value in detecting retroperitoneal rupture of the duodenum.

Hyperamylasemia in a patient with nonprogressive clinical findings and a normal gastroduodenoenterogram suggests the diagnosis of traumatic pancreatitis in which there is no interruption of the major elements of the ductal system. Such injuries

are likely to respond to non-operative therapy. Progressive abdominal findings indicate the rupture of larger ducts or an associated nonpancreatic injury which will require operative treatment.

Radiological Studies

In evaluating the traumatized abdomen, routine films of the upright chest, supine abdomen, and decubitus abdomen with the right side up should be obtained. The chest film yields precise diagnostic information regarding the thorax and upper abdomen. Pneumothorax, hemothorax, intrapulmonary contusion, diaphragmatic rupture with herniation, and free subdiaphragmatic gas are all readily detectable. Knowledge of supradiaphragmatic or diaphragmatic injury is of value in the interpretation of abdominal findings. Additionally information from the chest film aids the anesthetist in his management of the patient during operation and also serves as a control should aspiration pneumonitis or delayed post-traumatic changes develop. The location of intra-abdominal missiles is readily detected and allows for planning of the initial incision in the exploration of gunshot wounds, although such information is not totally reliable in predicting the injuries which can be expected.

Intravenous Urography

Intravenous urography and cystography are indicated studies when abdominal trauma has resulted in hematuria. Even in the absence of hematuria an intravenous urogram may yield helpful information in penetrating wounds in which injury of a kidney or ureter is suspected. In such cases the preoperatively obtained knowledge that the renal collecting systems and ureters are uninjured may eliminate the need for operative exposure of these structures. Alternatively, should a renal lesion be discovered which is best treated by nephrectomy, the preoperative status of the contralateral kidney becomes critically important. Aortography is indicated whenever unilateral nonvisualization is discovered with intravenous urography. Only through the use of aortography in such cases can a major renal vascular pedicle injury be detected early enough to allow for successful vascular repair and salvage of renal function.

Gastrointestinal Studies

Studies of the upper gastrointestinal tract using water-soluble contrast media may be utilized to detect intestinal injury in cases where repeated examination during observation has been inconclusive. Such studies have been particularly valuable in the early diagnosis of retroperitoneal rupture of the duodenum. The presence of hyperamylasemia is considered an absolute indication for gastroduodenoenterography. A program of nonoperative therapy for the diagnosis of traumatic pancreatitis should never be initiated until duodenal and enteric perforations have been excluded by such a study.

Aortography

Aortography and particularly selective angiography may yield precise information in cases of splenic and other visceral injury. The dividing line between the use or nonuse of aortography in a patient in whom it is required for the detection of such injury but in whom adequate indication for exploratory surgery does not exist is very difficult to define. We do not advocate the routine use of aortography in the evaluation of abdominal trauma but restrict its use to highly selected cases.

"Stabograms"

The injection of water-soluble contrast media into the tract of abdominal stab wounds has been advocated for the demonstration of peritoneal penetration. Because hazardous injury is often absent in the presence of abdominal penetration, a decision to operate based on proof of parietal peritoneal penetration will result in unnecessary celiotomy on many patients. Additionally, the contrast material in the parietes produces both pain and tenderness. Therefore, it is of limited usefulness in a policy such as outlined, where changing physical signs are important. Furthermore, "stabograms" have occasionally failed to demonstrate peritoneal penetration in patients with visceral injury in whom confusion due to the parietal irritation caused by the study delayed operation.

Abdominal Paracentesis

A useful aid to diagnosis of visceral abdominal injury is the peritoneal tap. Its greatest value is in the detection of hemoperitoneum where the physical findings are minimal, when associated head or chest injury makes physical signs difficult to interpret, or in the very young or very old patient with whom communication is difficult. The test is extremely safe and rarely yields falsely positive findings. Our most commonly employed method is paracentesis using the standard spinal needle. An 18-gauge spinal needle is inserted into the approximate center of each of the four abdominal quadrants with the patient in the supine position. When each needle has been felt to "pop"

through the peritoneum, the obturator is removed and gentle suction applied with a syringe. If diagnostic fluid is returned the procedure is terminated. If not, the needle is left open and in place for several minutes. The use of a few additional refinements may allow the detection of existing fluid which might otherwise be overlooked. After all four needles have been placed, the patient is asked to "bear down" or alternatively pressure is made on the central abdomen by the examiner. If there is still no aspirate, the patient can be turned from side to side. Lastly, air injected into one or more of the needles may result in the appearance of peritoneal fluid. All needles should be left open between these maneuvers.

Prevention of the false positive tap has been of particular concern. The depth to which the needles are placed is of considerable importance in avoiding visceral penetration. This occurrence has little danger in itself but the fluid yielded may result in the decision for an unnecessary celiotomy. The "feel" of the needle passing first through the resistance of fascia and the muscle but then "popping" freely into the peritoneal cavity can be easily appreciated. The needle need not be advanced further. Avoidance of the liver and spleen by checking for possible enlargement prior to the tap should be routine. The course of the deep inferior epigastric vessels should be avoided as should taps near previous surgical incisions. A few milliliters of blood may be obtained from needle punctures of visceral or parietal vessels and this will be indicated by the clotting of such blood. Free-flowing, nonclotting blood is the usual finding if significant intraperitoneal bleeding has occurred. Aspiration of intestinal contents most commonly means that the needle has punctured intact bowel. Spillage of enteric contents due to the initial injury usually gives such unequivocal physical signs that peritoneal tap is not required for a diagnosis.

The use of peritoneal dialysis catheters or "intercaths" with and without diagnostic irrigation techniques has recently been advocated. Our experience with these techniques has been limited but as yet no clear advantage over the safer and simpler needle paracentesis has been shown.

Summary and Conclusions

This presentation of the methods utilized in the evaluation of the traumatized abdomen has been made for the purpose of elucidating the diagnostic methodology which has been developed in recent years for the management of patients with abdominal trauma. Immediate exploratory surgery upon all patients with major abdominal trauma despite the absence of specific findings of visceral injury is a time-honored surgical policy. In certain circumstances surgery should be carried out in the absence of such findings. These include gunshot wounds, situations where the condition of the patient makes findings unreliable, and cases of overt intra-abdominal hemorrhage or peritonitis. However, in many patients with abdominal trauma a more deliberate approach can safely be followed. The mainstay of this policy is frequent, periodic examination of the patient integrated with the expanded use of laboratory and radiological studies. Over the last decade our experience with this approach has demonstrated that many patients can be safely managed without celiotomy. Further, more precise preoperative diagnosis has allowed for better operative management.

(The references may be seen in the original article.)

OBSCURE GASTROINTESTINAL HEMORRHAGE

John R. Ross, MD, Med Clin N Amer 53(2):417-423, March 1969.

One of the most frustrating problems in obscure hemorrhage continues to be the identification of the site of bleeding from the alimentary tract. Occult and intermittent bleeding are usually the most difficult problems to evaluate, but acute, massive, and sometimes exsanguinating hemorrhages can be equally difficult to locate, and of course are immediately hazardous to the patient's life.

Differential Diagnostic Considerations

Source of patient population and type of practice may alter the recordable experience in large areas of medical writing, and this particularly applies to bleeding from the gastrointestinal tract. Table 1 attempts to list, for various levels of the alimentary canal and in decreasing incidence, the most frequently encountered causes of obscure hemorrhage.

Table 1. *Causes of Obscure Hemorrhage*

Esophagus
- Varices, Mallory-Weiss tears } Massive hemorrhage
- Esophagitis
- Malignant disease
- Ulcer

Stomach
- Ulcer
- Gastritis
- Tumors (benign, malignant, and hamartomas)
- Hiatus hernia
- Telangiectasis
- Foreign bodies
- Toxins
- Postoperative bleeding

Small intestine
- Ulcer
- Crohn's disease
- Tumor (lymphoma, carcinoma, benign, and carcinoid)
- Mesenteric vascular accident
- Telangiectasis
- Intussusception (usually due to tumor)
- Duodenal diverticula
- Meckel's diverticulum (with aberrant glandular rest)

Colon and rectum
- Ulcerative colitis
- Crohn's disease
- Malignant disease
- Polyps
- Diverticulitis
- Telangiectasis

Extragastrointestinal bleeding
- Ulcerating pancreatic or ampullary carcinoma
- Hemoptysis or epistaxis
- Hemobilia
- Ruptured aneurysm

Blood dyscrasias
- Polycythemia rubra vera, with peptic ulcer
- Leukemia
- Thrombocytopenic purpura
- Hypoprothrombinemia
- Fibrinogenopenia

Miscellaneous
- Uremia
- Telangiectasis (Rendu-Osler-Weber disease)
- Peutz-Jeghers disease
- Periarteritis nodosa
- Anticoagulant drugs

These multiple possibilities must be seriously considered, depending upon the presenting symptoms.

History

If the patient with massive hemorrhage is comatose and has arrived by ambulance without relatives or friends, emergency measures must be immediately undertaken without the very helpful advantage of a history. It is necessary, when possible, to document evidence of previous hemorrhage and its severity, with or without hematemesis. The importance of a history of a familial blood dyscrasia or of gastrointestinal hemorrhage cannot be overstated. Has the patient used antacids or does he have a history of peptic ulcer? Has he used ulcerogenic drugs, alcohol, anticoagulants, or salicylates, particularly with steroids? If the patient has had hematemesis and it is of the projectile variety, the possibility of Mallory-Weiss syndrome or varicosities of the lower esophagus is raised. The age at which bleeding occurs in the presence of longstanding anorexia and weight loss is helpful in determining the probability of a malignant condition as the cause for occult bleeding. When bleeding occurs from various areas of the alimentary tract, systemic disease, such as blood dyscrasias, blood vascular disorders, and uremia, are prominent possibilities. It is helpful in determining the extent of the hemorrhage to have some knowledge of the patient's previous blood pressure levels.

Diagnostic Approach

Physical Observation

If the patient has had major blood loss, immediate efforts must be made to combat shock or impending shock by the replacement of blood and by balancing fluid and electrolyte requirements. Hourly monitoring of blood pressure, pulse, and respiration is paramount. Pain frequently does not accompany massive gastrointestinal bleeding, and the absence of pain should not mislead the physician's thinking as regards the serious nature of the situation. The palpability of the spleen and liver, the evidences of spider angiomas over the upper torso, neck, and palms, and visible distention of veins are helpful diagnostic leads to liver disease. Demonstration of a large spleen without the foregoing hepatic stigmata suggests possible blood dyscrasia. Prompt review of the epigastrium for the characteristic mass of a malignant tumor and the exclusion of a Virchow's scalene node or Blumer's rectal shelf are essential examinations. Demonstration of purpuric areas below the blood pressure cuff is suggestive of a blood dyscrasia, and evidence of occult upper gastrointestinal bleeding can be demonstrated by the recovery of a black, tarry stool.

Laboratory Analysis

The hemogram should be supplemented by counts of platelets and reticulocytes, determinations of prothrombin, bleeding, and clotting times, and when indicated, a Bromsulphalein dye retention test. Bilirubin and additional liver profile tests, including transaminase, albumin-globulin ratio, cholesterol, floccula-

tion, and turbidity determinations, are needed when liver disease is seriously considered. Determination of the levels of blood urea nitrogen and blood sugar, and urinalysis, are routine examinations. When bleeding has been massive, serial determinations of the blood urea nitrogen are important as a measure of the cumulative effect of residual blood slowly metabolized in the intestine. Serial measurements of electrolyte levels and stool examinations for occult blood are required to reflect the re-establishment of homeostatic balance.

When upper gastrointestinal bleeding has been massive and hematemesis is protracted, it may be necessary to employ the double lumen esophagogastric tube to bring about prompt cessation of bleeding through tamponade, if bleeding arises from this area. Under these conditions, early esophagoscopy is indicated after sufficient restoration of blood volume to exclude the presence of esophageal varices and the Mallory-Weiss lesion. At the same time, malignant lesions and esophageal inflammatory disease can be excluded. The physician can be reasonably certain that the hemorrhage originates in the medial or antral portions of the stomach or proximal duodenum if, after thorough evacuation, clots of fresh blood can be aspirated through the gastric lumen of the double-lumen tube when adequate obliterative vascular pressure has been applied at the esophagogastric level.

In the absence of esophageal disease, the stomach should be briskly evacuated of residual blood clots using ice water lavage. In performing this maneuver, we prefer to utilize a No. 26 French, Ewald's evacuator tube that has had several large apertures created in its distal portion to provide easy aspiration of the large clots of blood routinely present. These clots are easily broken up by vigorous lavage with up to a liter of ice water. We have found adequate pressure can be exerted both positively and negatively by utilizing a large compressible bulb at the proximal end of the tube while performing this procedure. After sufficient cleansing of the stomach, gastroscopic examination is immediately undertaken, and depending upon its findings, the examination is followed by the introduction of diatrizoate methylglucamine (Gastrografin) through a nasogastric catheter under fluoroscopic control. This examination can safely be performed in the radiographic laboratory, the patient having been transported by stretcher with, when necessary, fluid, electrolytes, and blood running parenterally and simultaneously into two or more extremities as the occasion demands during the course of this emergency diagnostic review.

Under conditions of occult bleeding, when the level of bleeding is not certain and all of the preceding measures including the barium study of the entire gastrointestinal tract have been unproductive, three additional examinations may be helpful. None of these can be depended upon, however, unless during the period of examination the patient is actively bleeding. Recovery from the intestine of red cells previously tagged with chromium or phosphorus and parenterally injected establishes the level of bleeding at the site where radioactivity first appears.

The fluorescein string test (which is a modification of Einhorn's string test developed in 1909) is occasionally helpful in establishing the origin of bleeding if it occurs in the upper gastrointestinal tract as far down as the proximal jejunum. The string, which is also marked with radiopaque material that can be visualized under the fluoroscope, is passed 12 hours before examination for occult blood. If we can be reasonably certain that the patient is actively bleeding, but bleeding is not massive, it is usually desirable to pass a Miller-Abbott tube into the stomach so that a serial record of occult blood determinations may begin. The test results are not considered to be significant by the guaiac technique unless they show at least a 3 to 4 plus positivity.

The benzidine and toluidine tests are too sensitive for practical clinical determinations of gastrointestinal bleeding. These two tests should be reserved for medicolegal examinations in which the evidence for blood (not quantitative evidence) may be critically important. The results of the guaiac determinations are progressively recorded after the tip of the tube proved to be in the small intestine by fluoroscopy. Determinations are made at 4-inch to 6-inch intervals until the first strongly positive reaction for occult blood is obtained.

At this point, very thin barium or diatrizoate methylglucamine is introduced through the Miller-Abbott tube into the lumen of the intestine, and a film is made at this juncture, locating the tip of the tube with reference to the radiopaque column filling the remaining intestine down to the ileocecal valve. The surgeon now has a point of reference upon which to concentrate his attention, and depending upon his observations and palpation, it may be necessary for him to perform single or multiple enterotomies evaginating the mucosa proximally and distally at serial levels to establish the definitive site of the bleeding. These enterotomies should originate

just proximal to the level where bleeding was first discovered and should then progress at regular intervals distally.

If it is fairly certain that bleeding does not arise from the esophagus, stomach, or small intestine, the approach to establishing the level of bleeding from the large intestine is as follows: first, after thorough preparation with a cleansing enema, a sigmoidoscopy should be carefully performed. A Fleet enema is given 30 minutes before the examination—in our experience a very satisfactory agent for preparing the rectosigmoid colon for sigmoidoscopy. The patient should have been given Fleet's Phospho-Soda by mouth the previous afternoon, so that as much formed residue in the colon may be evacuated as possible. The selection of an adequate preparatory purgative becomes a matter of the physician's choice and experience. No two patients react in the same manner, and in general the decision should be based upon best results with least discomfort to the patient.

If bright red blood can be visualized above the tip of the sigmoidoscope, it is reasonable to assume that bleeding arises from the descending colon. If the blood is not bright and has the color of port wine, there is moderate intraluminal blood disintegration, with the bleeding undoubtedly arising from the right colon. A barium air contrast enema now is in order, since presumably the original barium enema has been unrevealing. The air contrast examination is especially important in excluding intraluminal polypoid disease, a relatively common cause for bleeding from the colon and rectum. When polyps are demonstrated by their constant presence on more than one air contrast examination, this radiographic evidence is extremely helpful to the surgeon, particularly when he cannot palpate the small polyp. He is then obliged to perform a colotomy at the prescribed level for removal of the lesion.

If the lesion is not clearly demonstrated, a transverse colostomy should be undertaken for evaluation of future bleeding. Examinations of stool content can then be continued periodically until bleeding resumes, and hopefully the problem of its origin then can be resolved. Blind resections are emphatically discouraged, since, as this operation implies, the site of bleeding has not been established, and therefore the procedure is often doomed to failure. This particularly applies to the formerly recommended procedures involving blind removal of the ascending colon and gastric resection.

When the clinician feels strongly that bleeding is arising from a duodenal ulcer on the posterior wall even though he lacks positive evidence, it is extremely important that he urge his surgeon not to rely solely upon palpation of the duodenum or its mobilization for confirmation of a posterior wall ulcer. Instead he should open the anterior wall of the duodenum for direct inspection of the mucosal surface, as this frequently is the only means of identifying a bleeding vessel on the posterior wall of the duodenal bulb or the proximal descending duodenum. We would then probably choose to perform a hemigastrectomy and vagotomy, depending upon the nutritional status of the patient and his hydrochloric acid secretory capacity, previously established by an augmented Histalog gastric analysis. If the acid secretory capacity of the parietal cells is high and if obesity is a problem, a slightly more radical gastric resection might be undertaken. If malnutrition is a problem and gastric secretory capacity is not excessive, pyloroplasty and vagotomy may be elected.

Success in establishing a site of origin for bleeding may be prevented if hemorrhaging ceases soon after the patient enters the hospital. Measures for provoking further bleeding, such as the use of anticoagulants, have not been successful. This difficulty arises particularly with intermittent occult bleeding. The patient must be encouraged to alert the physician immediately upon the recognition of active bleeding, so that prompt hospitalization and study can be instituted. Recently, angiography has been extremely helpful in selected instances in the identification of small, obscure intestinal lesions such as hemangiomas.

Management

Reference has been made to the prompt and active measures to be introduced in the presence of shock or impending shock. In addition to careful monitoring of the vital signs and physical dynamics, an accurate record of the fluid intake and output must be detailed for the patient who has bled massively. These patients are frequently apprehensive, and it is essential for them to receive sedation around the clock, preferably with one of the barbiturates, such as pentobarbital, intramuscularly, 100 mg. every 6 to 8 hours, unless liver disease does not permit the use of barbiturates or opiates. We prefer not to use opiate derivatives because of their undesirable effects in larger doses upon the gastrointestinal tract and because they depress the respiratory center. Bed rest and relaxation are helpful in assisting nature to bring about natural hemostasis.

Anticholinergic agents are probably more effective on the motility than upon the secretory function of the gastrointestinal tract and are therefore natural adjuvants to hemostasis. The problem of the management of peptic ulcer diathesis is discussed in another paper in this volume (p. 425) and will not be reviewed here. In our opinion, in the presence of a massive upper gastrointestinal hemorrhage, all oral intake should be stopped until bleeding ceases, after which gradual oral alimentation with a bland diet can be instituted.

High levels of ammonia in the blood usually indicate some degree of liver dysfunction that prevents adequate handling of the metabolism of urea arriving in large amounts as a result of the action of urease-splitting organisms upon large accumulations of blood in the intestine. Cleansing by irrigation is periodically necessary to free the colon of this deleterious response of the body to blood lying in the colon.

The extent of iron deficiency that results from blood loss is measured by determining the level of serum iron and total iron binding capacity. If the level of serum iron is low (below 80 μg. per 100 ml.) and the total iron binding capacity is elevated (above 250 μg. per 100 ml.), iron should be administered in the form of ferrous sulfate or ferrous gluconate, preferably in doses of 300 to 600 mg. three times daily, until the serum iron levels are restored and the normal iron content can be utilized from dietary sources. Parenteral iron (for example, iron dextran, Imferon) is indicated when oral intake is restricted or when rapid restoration from very low values to normal is desired. It is usually desirable to supplement the oral program with ascorbic acid in quantities of 200 to 500 mg. daily and with vitamin K in the presence of low prothrombin levels. Vitamin K activity can be rapidly ascertained by determining the prothrombin time 12 to 24 hours after the injection of parenteral vitamin K (for example, 72 mg. of menadione sodium bisulfite, Hykinone) and comparing it with the fasting level. The prothrombin time in the absence of liver or biliary tract disease should then return to normal. If previous prothrombin levels have been low, it would be wise to provide maintenance with vitamin K given orally until the situation becomes stabilized. Multivitamins in the amounts of their daily minimal requirements should be given orally once or twice daily until the oral nutritional intake satisfactorily provides vitamins.

We have used hypothermia in the management of upper gastrointestinal bleeding on one occasion early in the course of the development of this technique, and it was unsuccessful in producing hemostasis. We are in full agreement with the concept that hypothermia for the control of upper gastrointestinal bleeding at the freezing level is not safe and effective when compared with other forms of therapy. Cooling for upper gastrointestinal bleeding from causes other than ulcer has not been justified, since the procedure is not without discomfort, and in our experience it is more traumatic and less successful than other approaches to these problems.

Occult bleeding is more often encountered than massive bleeding, and since these patients are frequently unaware of their bleeding problem before it becomes critical, their lives may in fact be in as great a jeopardy as those of patients with massive hemorrhage. In the latter instance, the very acute nature of the illness forces immediate medical attention and, in a reasonable proportion of patients, results in early resolution as to the site of bleeding. Early therapy can then be instituted. It is equally important to screen the patients with occult bleeding and to use all diagnostic tools available to demonstrate the cause of bleeding so that potential catastrophe can be averted.

GASTRITIS

Keith B. Taylor, MD, New Eng J Med 280(15): 818-820, April 10, 1969.

Diffuse inflammation of the gastric mucosa may be described as gastritis. Most of our knowledge relates to pathologic changes in the gastric gland area or body of the stomach, but similar changes in the gastric antrum have been little studied. The mucosa of the body of the stomach contains acid-producing or parietal cells and chief cells, which appear to contain at least one gastric pepsinogen. Castle's intrinsic factor, an essential for the physiologic absorption of trace amounts of vitamin B_{12}, also is probably elaborated, in man, in the parietal cells. Normal body mucosa contains few inflammatory cells. Collections of lymphocytes and a few macrophages, plasma cells and eosinophils are sometimes present.

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An increase of the number of inflammatory cells justifies the diagnosis of gastritis, which is, emphatically, a histologic one and should be based on the examination of multiple biopsies of the gastric mucosa. Lesions are often asymptomatic. Tests of secretory function, gastroscopic and radiologic appearances and immunologic tests are adjuncts to diagnosis, and correlative studies may help to extend our knowledge of this disease or group of diseases that only achieved respectability with the advent of suction biopsy of the gastric mucosa.

The simplest classification of gastritis is as follows:

Acute Gastritis

The lamina propria is infiltrated to a variable density with polymorphonuclear leukocytes and sometimes eosinophils. The distribution may be mainly superficial, or it may be generalized. In more severe cases there may be punctate or widespread erosion of the mucosal surface, extravasation of red blood cells, edema and disruption of the normal glandular pattern. Hemorrhage may be severe. Nausea and epigastric pain may occur, but, as with chronic gastritis, the lesions may be asymptomatic. Ingestion of alcohol, salicylates, some bacterial toxins and corrosives are probably the commonest causes. Some studies suggest that the gastric mucosa is capable of complete repair after such an acute episode.

Chronic Gastritis

In this group of conditions the mucosal infiltration is predominantly mononuclear and polymorphonuclear forms are often present only in small numbers. The other features are a variable degree of glandular atrophy and metaplastic changes toward a small intestinal type of mucosa. Serial biopsy establishes the chronicity of the changes. Chronic gastritis is usually classified as chronic superficial, in which glandular atrophy is minimal, chronic multifocal, or chronic diffuse. In gastric atrophy inflammatory cells are few, and glandular atrophy is extensive. It has yet to be established that any one of the minor changes observed represents a stage in the evolution of complete gastric atrophy. The observed prevalence of chronic superficial gastritis is much greater than that of chronic atrophic gastritis and gastric atrophy, so that it is unlikely that the former invariably or usually precedes the latter, except perhaps in individual cases or in groups of subjects, unless the natural history of the disease comprised by the term chronic gastritis has changed significantly in recent years.

Histochemical studies have shown that changes in enzyme activities of gastric epithelial cells and parietal cells correlate with the degree of mucosal damage. In intestinal metaplastic tissue, enzymes occur that are typical of small intestinal mucosa and are not found in normal gastric mucosa. There is some evidence that such mucosa undergoes a change to an absorptive rather than a secretory function. The turnover of gastric epithelial cells appears to be higher in treated pernicious anemia and atrophic gastritis than in the normal stomach.

The secretion of hydrochloric acid and pepsinogen is usually impaired or absent when extensive chronic gastritis is present, but occasionally there is a remarkable discrepancy between biopsy and secretory findings. The production of Castle's intrinsic factor may now be measured directly by immunoassay of gastric juice instead of indirectly on the basis of studies of absorption of vitamin B_{12}. It has thus been shown that its secretion, which normally is vastly in excess of minimal requirements, is impaired according to the degree of gastric atrophy, but again, histologic and secretory data do not always correspond and it is impossible to diagnose with confidence the basic lesion of pernicious anemia from the histologic appearances of the mucosa.

The prevalence of chronic gastritis in any population is unknown. Often, it is asymptomatic. The results of gastric biopsy of an adequate and representative population of all ages have not been reported. Such studies alone could provide information about the prevalence of gastritis, though immunologic tests may prove to be most valuable as a screening procedure.

Causes of Chronic Gastritis

These are unknown. Speculation has embraced physical or chemical injury, infection, nutritional deficiency, especially of iron, autoimmunologic factors and endocrine dysfunction. In pernicious anemia there is some inconclusive evidence that genetic factors may be involved.

Evidence of qualitative differences between various sorts of chronic gastritis, indistinguishable histologically, may be derived from immunologic studies. An antibody against an incompletely characterized microsomal component of the gastric parietal cell may be detected in about 90 percent of all subjects with pernicious anemia. In those with apparently spontaneous chronic atrophic gastritis without pernicious anemia, or in those with chronic iron deficiency and chronic gastritis, the prevalence of this antibody

is of the order of 50 percent, whereas after partial gastrectomy for duodenal or gastric ulcer extensive gastritic changes seem to occur in the absence of any detectable immune response. Yet the gastric histology in the various types of chronic gastritis may be indistinguishable. Circulating antibodies that combine at two different sites with Castle's intrinsic factor have been detected in many patients with pernicious anemia. One type blocks the combination of intrinsic factor with vitamin B_{12} (blocking or Type 1 antibody); the other (binding or Type 2 antibody) reacts with both intrinsic factor alone or its complex with vitamin B_{12}. These antibodies are not present in subjects with other forms of chronic gastritis, and this, together with their frequent presence in gastric juice in pernicious anemia, has provoked speculation that malabsorption of vitamin B_{12} in pernicious anemia may sometimes be due in part to the inhibition of intrinsic-factor activity as well as reduction in its secretion. The parietal-cell antibody as well as the intrinsic-factor blocking antibody are present in gastric juice. Recently, in pernicious anemia, antibody-containing mononuclear inflammatory cells in gastric mucosa have been shown to contain parietal-cell antibody and intrinsic-factor antibodies of the "binding" type. The pathogenic significance of these findings is not yet clear.

It is of interest that some patients with pernicious anemia respond to corticosteroids by improvement in absorption of vitamin B_{12} associated with increased secretion of intrinsic factor and possibly a fall in concentration of circulating intrinsic-factor antibody. Prolonged administration has occasionally been associated with some transiently increased counts of parietal cells in the gastric mucosa and the return of capacity to secrete small amounts of hydrochloric acid. These findings are of interest regarding the nature of the disease and the dynamics of the gastric mucosa but at present do not appear to have serious therapeutic implications.

The association of chronic gastritis and hyposecretory states of the gastric mucosa with various types of endocrine dysfunction has been the subject of much speculation. Hypopituitarism in man and in animals seems to result in a reduction of gastric mucosal mass and secretory function. The changes are reversible and are those more of abiotrophy than of atrophic gastritis. In thyrotoxicosis, myxedema and Hashimoto's disease the lesion of pernicious anemia may be present, but decisive evidence that the relations are significantly greater than those of chance association is still lacking. The latency of chronic gastritis and of degrees of endocrine disease makes any firm conclusion impossible. However, immunologic studies have shown unequivocally that in these thyroid diseases and in Addison's disease and diabetes mellitus, there is a predisposition to produce autoantibodies against specific components of gastric, thyroid, and adrenal tissues.

Gastric Carcinoma and Chronic Gastritis

At operation or autopsy chronic gastritis is found in association with gastric carcinoma to a variable extent. Whether gastritis is a precancerous lesion, however, is not clear. Reported follow-up studies of a population with biopsy-proved gastritis have not provided adequate data, although one study from Finland suggests that in that population chronic gastritis carries a considerable risk of developing into gastric carcinoma. Studies in the United States, Denmark, and the United Kingdom suggest that gastric carcinoma is about three times as common in subjects with pernicious anemia as in the population at large. Regarding chronic gastritis without pernicious anemia there are no published data from these countries.

Conclusions

It seems proper to emphasize our ignorance of the causes and natural history of gastritis of the body of the stomach, and to anticipate some illumination of this field through the correlation of properly derived functional, histochemical, immunologic, genetic, and environmental data.

(The references may be seen in the original article.)

MEDICAL ABSTRACTS

SURGICAL AND PATHOLOGICAL EVALUATION OF VASCULAR INJURIES IN VIETNAM

LTC N.M. Rich, MC USA, W.C. Manion, MD, and COL C.W. Hughes, MC USA, J Trauma 9(4):279-291, Apr 1969.

The recommendation to excise 1 cm of grossly normal artery, both distal and proximal to the obvious injury, has had its advocates both in the Korean conflict and recently in Vietnam.

In an attempt to determine the justification for this recommendation, 100 arterial segments were collected in Vietnam for pathological study.

At Walter Reed General Hospital 65 of these patients have been followed to date. In this series there were 20 (31%) initial repair failures. Twelve of 28 vein graft repairs failed (43%).

The over-all amputation rate of 15% in this series is slightly higher than the 12.7% rate in 365 major arterial injuries previously reported from the Vietnam Vascular Registry. Of the ten amputations, nine involved vein graft repairs.

Findings thus far do not substantiate the routine recommendation for sacrifice of 1 cm of normal artery on each side of an arterial injury. This does not guarantee success, and is frequently not necessary for a successful repair.

The surgical judgment and technical capability of the operating surgeon contribute most to the success of an arterial repair. Associated osseous and soft tissue injuries, concomitant vein damage, surgical time lag, and possible wound infection also affect the ultimate outcome.

Further investigation of this question is warranted, and will continue.

VIRUSES IN CARCINOGENESIS

Renato Dulbecco, MD, Ann Intern Med 70(5): 1019-1030, May 1969.

This article reviews the role of viruses in cancer. Oncogenic viruses may contain either ribonucleic acid (RNA) or deoxyribonucleic acid (DNA). The small DNA viruses, polyoma virus and SV40, are best known in terms of genetics and molecular biology. Cell transformation by these viruses includes two steps: first, the integration of the viral DNA in the cellular DNA; and secondly, the expression of viral transforming functions. If integration fails, the cells undergo abortive transformation and then return to normality. In the transformed cell only some of the viral genes are transcribed into messenger RNA, and this accounts for the survival of the cells. The RNA viruses are less well known. They produce either leukemias with very low efficiency or (sometimes) sarcomas with a high efficiency. The sarcoma viruses often have complex biology.

An extensive search is going on for viruses as possible agents of human cancer. The most interesting virus is the one found in the Burkitt's lymphoma cells and, in all likelihood, the agent of infectious mononucleosis. The search for human cancer viruses is beset by great difficulties, both methodological and conceptual.

THE BURN AUTOPSY

F.D. Foley, MD, Amer J Clin Path 52(1): 1-13, July 1969.

The pathologic findings and interpretations of 335 autopsies performed on patients who died of extensive cutaneous burns during the period 1960 to 1967 are presented. The information accumulated during this period is unique in that the burn wounds were systematically examined postmortem, the patients studied were young, and the number with preexisting disease was negligible. Comparison of the major fatal complications prior and subsequent to topical antibacterial therapy confirms the marked decline in sepsis due to invasive bacterial infection of the burn wound that has been reported previously. There has been an increase in fungal colonization and infection of the burn wound coincident with the use of the topical antibacterial agent, Sulfamylon. Sepsis, although reduced in magnitude due to control of one of its major sources, continues to be the single most frequent fatal complication of burns. Infective and respiratory complications together account for two-thirds of deaths in patients who survive the initial phase of thermal injury. The infected cannulated vein now rivals infection of the burn wound as a source of sepsis in burned patients The increase in deaths at-

tributed to respiratory complications has occurred only in patients with extensive burns and may be an apparent rather than a real increase.

SALICYLATE INGESTION AND IDIOPATHIC HAIR LOSS

H.M. Rawnsley, MD, and W.B. Shelley, MD PhD, Lancet I (7542): 567-569, Mar 16, 1968.

During an investigation of coproporphyrin excretion in cases of idiopathic hair loss an unexpected blue fluorescence was detected in the urine. Chromatographic and spectrophotofluorometric properties characterized this "blue spot" as being caused by *o*-hydroxyhippuric acid, a urinary metabolite of salicylate. The blue spot disappeared if salicylates were forbidden, but could be induced in previously normal urine if clinical doses were given to controls. This unexpected "aspirin addiction" might reflect underlying chronic disease in patients with unexplained hair loss, cause gastrointestinal bleeding leading to anaemia and hair loss, or act directly by interfering with cellular activity necessary for hair production.

DECREASED INCIDENCE OF ANTIBIOTIC RESISTANCE AMONG *STAPHYLOCOCCUS AUREUS*

R.J. Bulger, MD, and J.C. Sherris, MD, Ann Intern Med 69(6): 1099-1108, Dec 1968.

Data on antibiotic sensitivity tests for all *Staphylococcus aureus* strains isolated from clinically significant sources in hospitalized patients over a 9-year period have been tabulated and compared. There was an unquestionable trend toward increasing sensitivity to the majority of antibiotics tested, and there has been a striking decrease in the incidence of multiple-resistant strains. The proportion of strains sensitive to all antibiotics tested or resistant only to penicillin G increased from 9% in 1959 to almost 80% in 1966 and 1967. Over the 9-year period a decreasing proportion of hospitalized patients yielded *S. aureus* from lesions. In spite of an increasing hospital census, the total number of serious staphylococcus infections as reflected by positive blood cultures showed a marked, progressive decline between 1959 and 1966, although there was a sizable rebound in 1967.

AN EPIDEMIC OF CLAM-ASSOCIATED HEPATITIS

Shaun J. Ruddy, MD, et. al., JAMA 208(4): 649-655, Apr 28, 1969.

During a 32-week period from November 1963 through June 1964, an epidemic of 123 cases of viral hepatitis following ingestion of raw clams occurred in Connecticut. Several observations supported the incrimination of raw clams as the vehicle: a high proportion of cases among adult males, a low proportion of patients having history of contact with a previous case, the occurrence of cases in two epidemic waves, the similarity between the known incubation period of infectious hepatitis and the intervals from consumption of raw clams to onset of illness, and results of a survey which indicated that more than six times as many hepatitis patients had eaten raw clams as had persons without hepatitis. The clams probably came through the regular commercial channels from several suppliers, but their harvesting waters could not be identified.

ABDOMINAL SURGERY IN THE PRESENCE OF ACUTE PANCREATITIS

R. Cohen, MD, J.T. Priestley, MD, and J.B. Gross, MD, Mayo Clin Proc 44(5): 309-317, May 1969.

Of 30 patients treated surgically and found at operation to have acute pancreatitis, 26 had a preoperative diagnosis of acute pancreatitis and in the remaining 4 the preoperative diagnosis was uncertain. In 21 of the 26 patients some abnormality in the biliary tract was also diagnosed preoperatively and in 19 of these 21 it was thought that stones were present in either the gallbladder, the common bile duct, or both.

Twenty-eight of the 30 patients had acute edematous pancreatitis and the remaining 2 had acute hemorrhagic pancreatitis. At operation 19 of the 30 were actually found to have disease in the biliary tract. Two of the remaining 11 patients had acute postoperative pancreatitis, 1 had received blunt abdominal trauma, and in the remaining 8 no etiologic factor was identified.

Twenty-one of the 30 patients had some procedure performed on the biliary tract. Various procedures were performed on the remaining nine patients, except for two who had only a diagnostic laparo-

tomy. Two patients (6.7%) died. The 28 surviving patients, including the 2 with acute hemorrhagic pancreatitis, had an average postoperative stay of 14.7 days in the hospital.

TUBERCULOSIS PROPHYLAXIS

Francis J. Curry, MD, Arch Environ Health 18(6): 1002-1007, June 1969.

The role of chemotherapy and chemoprophylaxis in providing primary, secondary, and tertiary prophylaxis of tuberculosis is defined, with the establishment of priorities related primarily to high-risk groups among the infected population. The effectiveness of directing a prophylactic program against the infected population, the source of future disease, was contrasted with the results of the BCG Vaccination Trials in England, which was directed toward the uninfected population. The annual tuberculosis case rate among the BCG-vaccinated English students of 38:100,000 during the first five years after immunization was contrasted with the current US case rate of 24.1 and the big cities rate of 43.1.

TULAREMIA EPIDEMIC: VERMONT, 1968

Lowell S. Young, MD, et. al., New Eng J Med 280(23): 1253-1260, June 5, 1969.

North America's largest outbreak of tularemia linked to human contact with aquatic mammals occurred in the spring of 1968 in Vermont, a state with no previous reports of tularemia. Forty-seven cases were diagnosed in persons who had trapped or handled muskrats within a four-week period. Investigation revealed a wide spectrum of disease ranging from severe prostrating illness to inapparent infection. Almost all the symptomatic patients had fever and constitutional symptoms. Skin lesions and axillary adenopathy, although present in most symptomatic patients, were variable features. In the 46 patients who had agglutination titers of 1:160 or greater against *Francisella tularensis*, there was no correlation between titer and presence or absence of symptoms, severity of symptoms, duration of illness, or effect of treatment.

F. tularensis was identified in the exudate from the skin lesion of one patient. It was also cultured from water, mud, and 5 percent of the muskrats in the area of most intensive trapping.

RESEARCH SECTION

LIST OF RECENT PUBLICATIONS FROM RESEARCH LABORATORIES

The following papers have been completed by research activities under the direction of the Bureau of Medicine and Surgery.

Naval Aerospace Medical Institute, Pensacola, Fla.:

"Evaluation of Otolith Organ Function by Means of Ocular Counterrolling Measurements" by Earl F. Miller II. NASA Joint Report. NAMI-1063, March 1969.

"Visual Horizontal-Perception in Relation to Otolith-Function" by Earl F. Miller II, Alfred R. Fregly, and Ashton Graybiel. *American Journal of Psychology,* Vol. LXXXI, December 1968.

Naval Hospital, Philadelphia, Pa.:

"Methadone Toxicity in a Child" by William S. McCurley and Walter W. Tunnessen, Jr. *Pediatrics* 43(1), January 1969.

Naval Medical Psychiatric Research Unit, San Diego, Calif.:

"Excretion of 17-Hydroxycorticosteroids and Vanillylmandelic Acid During 205 Hours of Sleep Deprivation in Man" by R. T. Rubin, D. J. Kollar, G. G. Slater, and B. R. Clark. *Psychosomatic Medicine* XXXI(1), January-February 1969.

Naval Medical Research Institute, Bethesda, Md.:

"Antibodies to Larval *Taenia crassiceps* in Hibernating Woodchucks, *Marmota monax*" by Richard L. Beaudoin, David E. Davis, and K. D. Murrell. *Experimental Parasitology* 24(1), February 1969.

"Energy-Linked Reactions in Chemoautotrophic Organisms" by Lutz A. Kiesow. NMRI Report No. 3, July 16, 1968.

"Physics of Bubble Formation and Growth" by Richard G. Buckles. *Aerospace Medicine* 39(10), October 1968.

"Preservation of Human Skin" by Vernon P. Perry. *Journal of Cryo-Surgery,* Vol. 1, August 1968.

"Soybean Inhibitors" by David B. S. Millar, Gordon E. Willick, R. F. Steiner, and V. Frattali. *Journal of Biological Chemistry* 244(2), January 25, 1969.

U. S. Naval Medical Research Unit No. 2, Taipei, Taiwan:

"Antibodies to Larval *Taenia Crassiceps* in Hibernating Woodchucks, *Marmoto Monax"* by Richard L. Beaudoin, David E. Davis, and K. D. Murrell. *Experimental Parasitology* 24(1), February 1969.

"Care and Raising of Newborn Taiwan Monkeys (Macaca Cyclopis) for Virus Studies" by Czau-Siung Yang, Cho-Chou Kuo, J. E. Del Favero, and E. Russell Alexander. *Laboratory Animal Care* 18(5), October 1968.

"An Evaluation of Diagnostic Techniques in a Sample Survey for Intestinal Parasites" by John H. Cross and K. Darwin Murrell. *Chinese Journal of Microbiology,* Vol. 1, 1968.

"Growth and Development of Rats in Relation to the Maternal Diet: A Review" by B. F. Chow, R. Sherwin, A. Ma Hsueh, B. N. Blackwell, and R. Q. Blackwell. Bibl. "Nutrio et Dieta," No. 11.

"Human Angiostrongyliasis Involving the Lungs" by Chin-Yun Yii, Chang-Yi Chen, James W. Fresh, Tom Chen, and John H. Cross. *Chinese Journal of Microbiology,* Vol. 1, 1968.

"Leptospira Canicola Isolated from Dogs in Taiwan" by Che-Chung Tsai and James W. Fresh. *Journal of the Formosan Medical Association* 68(1), January 28, 1969.

"Nematode Parasites of Oceanica. IV. Oxyurids of Mammals of Palawan, P. I., with Descriptions of Four New Species of *Syphacia"* by Gerald D. Schmidt and Robert E. Kuntz. *Parasitology,* Vol. 58, 1968.

"New Species of Mosquitoes from Taiwan (Diptera: Culicidae)" by Jih Ching Lien. *Tropical Medicine* 10(4), December 1968.

"Respiration Studies and Glucose Absorption Kinetics of *Taenia Crassiceps Larvae"* by K. Darwin Murrell. *Journal of Parasitology* 54(6), December 1968.

"Serological Survey of Rodent Plague in Taiwan and Offshore Islands" by D. McNeill, H. Jenkin, D. Armstrong, Y. S. Chang, J. C. Lien, and K. F. Meyer. *Bull. Org. mond. Sante,* World Health Organization, Vol. 38, 1968.

Naval Medical Research Unit No. 4, Great Lakes, Ill.

"Antigenicity of a Stable Meningococcus L Form" by D. W. Beno and Y. E. Crawford. *Bacteriological Proceedings,* 1969.

"Excretion Patterns of Rhinovirus Infections in Military Recruits" by M. J. Rosenbaum, P. DeBerry, and E. J. Sullivan. *Bacteriological Proceedings,* 1969.

"Improved Isolation of Mycoplasma Pneumoniae with Dubos Oleic Albumin Complex" by W. H. Kraybill, G. M. Allen, and Y. E. Crawford. *Bacteriological Proceedings,* 1969.

Naval Submarine Medical Center, Groton, Conn.:

"Analyses of a Variety of Visual Problems Encountered During Naval Operations at Night" by Jo Ann Kinney, S. M. Luria, and D. O. Weitzman. SMC Report No. 545, August 30, 1968.

"Dental Calculus Formation Rate in a Submarine Environment" by L. W. Piebenga and W. R. Shiller. J Dent Res 47(4), July-August 1968.

"Effect of Rapid Eye Movement (Dreaming) Sleep Deprivation on Tension of Avoidance Learning in Rats" by Chester A. Pearlman. SMC Report No. 563.

"Extra-Alveolar Air Resulting from Submarine Escape Training: A Post-Training Roentgenographic Survey of 170 Submarines" by Reese E. James. SMC Report No. 550, October 15, 1968.

"Light Flashes, Pupil Size and Visual Performance: An Analysis of Discomfort in the Use of Electro-Optical Aids" by Jo Ann Kinney, Leah T. Spitz, and S. M. Luria. SMC Report No. 558, January 22, 1969.

"Maximum Rate Kinetic Analysis Applied to Enzyme Assay Data" by Donald V. Tappan. SMC Report No. 564, February 5, 1969.

"Performance Effects of Increased Ambient Pressure. I. Helium-Oxygen Saturation and Excursion Dive to a Simulated Depth of 900 Feet" by B. B. Weybrew and J. W. Parker. SMC Report No. 556, November 1, 1968.

"Salivary Acid-Base Levels During Exposure to an Elevated Carbon Dioxide Atmosphere" by Robert M. Lambert and William R. Shiller. SMC Report No. 549, October 11, 1968.

"Salivary Thiocyanate Secretion During a Fleet Ballistic Missile Submarine Patrol" by R. P. Wray and W. R. Shiller. SMC Report No. 561, January 27, 1969.

"Short Term Clinical Evaluation of a Clay Containing Dentifrice" by W. R. Shiller. SMC Report No. 565, February 12, 1969.

"Stereoscopic and Resolution Acuity with Varying Field of View" by S. M. Luria. SMC Report No. 557, December 6, 1968.

"Use of Snyder's Caries Activity Test in Oral Hygiene Effectiveness Monitoring" by John E. Wiseman and William R. Shiller. SMC Report No. 559, January 13, 1969.

DENTAL SECTION

PERSONNEL AND PROFESSIONAL NOTES

AMERICAN SPECIALTY BOARDS

The following listed officers of the Naval Dental Corps have recently met the requirements for certification as Diplomates of the respective American Specialty Boards:

American Board of Oral Surgery

CAPT Ethan C. Allen, DC USN
CDR John D. Cagle, DC USN
CDR Thomas W. McKean, DC USN
CDR Sidney (n) Raybin, DC USN
CDR Scott M. Smith, DC USN
CDR Bill C. Terry, DC USN
CDR James M. Wilson, DC USN

American Board of Prosthodontics

CAPT Robert W. Bruce, DC USN
CAPT Irving J. Wever, Jr., DC USN
CDR David N. Firtell, DC USN
CDR John B. Holmes, DC USN
CDR Gordon E. King, DC USN
CDR Ronald W. Lucker, DC USN
CDR Leonard E. Mark, DC USN
CDR Charles G. Strange, Jr., DC USN
CDR Ray A. Walter, DC USN
CDR Frederick B. Williams, DC USN

American Board of Endodontics

CDR Charles J. Cunningham, DC USN

NAVAL RESERVE DENTAL SYMPOSIUM

On 13 October 1969, in the New York Coliseum, a Naval Reserve Dental Symposium will be held at 1400–1600. This symposium is held each year in conjunction with the Annual Session of the American Dental Association. This year military officers of Federation Dentaire Internationale have been invited as honored guests. The program will include a "Welcome" by RADM Francis D. Foley, USN, Commandant, Third Naval District, RADM Edward C. Raffetto, DC USN, Assistant Chief of the Bureau of Medicine and Surgery (Dentistry) and Chief, Dental Division, will speak on "Naval Dental Corps —1969." VADM Arnold F. Schade, USN, Commander Submarine Force, Atlantic Fleet will be the principal speaker on the timely subject, "The Silent Service," and CDR William R. Shiller, DC USN, Naval Submarine Base New London will bring to our attention "Dental Services for Undersea Personnel." A reception will follow in the Astor Gallery of the Waldorf-Astoria Hotel, 1700–1900. These two events offer an excellent opportunity for dental officers on active and inactive duty to share a period of fellowship together.

NAVAL DENTAL CORPS CORRESPONDENCE COURSE PROGRAM

All new Naval Dental Corps correspondence courses will have self-scoring answer sheets, which

enable the student to know immediately whether he has answered the questions correctly. When answers are incorrect, the student is referred to pages in the text for further study before answering other questions.

This type of answer sheet was adopted because studies show that when there is immediate feedback, material is learned more readily and retained longer.

To support the Naval Dental Corps objective of keeping dental officers informed of the most recent advances in dental practice, the Naval Dental School is continually revising existing courses and developing new ones. The courses, which are developed by dental officers and an educational specialist, are designed to increase professional competency by placing emphasis on clinical application of material in the text.

Of the 14 courses now available, four were developed within the past 2 years. Four more new courses will be available within the next 6 months:

Fixed Partial Denture Prosthodontics, NavPers 10410–A, based on the textbook *Crown and Bridge Prosthodontics*, 2d edition, by Johnston, Phillips, and Dykema. The five assignments deal with diagnosis and treatment planning; instrumentation; tooth reduction; types of crowns and retainers; laboratory procedures and pontic design; procedures utilizing porcelain and resin materials; and special considerations in crown and bridge design.

Endodontics, NavPers 10407–B, based on the text *Endodontics,* NavPers 10782–B, written at the Naval Dental School. The course incorporated recent research findings in pulpal and periapical pathology and advances in technique. The four assignments include processes in pulpal and periapical pathosis; diagnostic procedures; preservation of the pulp; case evaluation; microbiological aspects, instrumentation, irrigation, medication, and filling of the root canal; surgical endodontic treatment; and bleaching.

Pharmacotherapeutics in Dental Practice, NavPers 13110, based on the textbook *Pharmacotherapeutics in Dental Practice,* NavPers 10486, also a Naval Dental School text. This subject is included in the correspondence course program for the first time. The course provides a review of drug information as it relates to modern dental practice, including both clinically useful information and fundamental pharmacology. The six assignments cover the general aspects of pharmacotherapeutics; prescription writing; hypnotics and sedatives; tranquilizers; analgesics; local anesthetics; antibiotics and sulfonamides; emergency drugs and other drugs of a special dental interest; and the use of drugs in special dental problems.

Periodontics, NavPers 10758–A, based on the textbook *Periodontal Therapy,* 4th edition, by Goldman and Cohen. Although the text is a product of many contributors, it presents a unified approach to the rationale and methodology of periodontics. The seven assignments cover all aspects of periodontics from prevention to case presentation and management.

The naval texts are valuable reference texts, and every effort is being made to have them placed on sale by the Government Printing Office.

All dental officers are encouraged to participate in the naval correspondence course program. Enrollment in military and dental courses is an excellent means of furthering competency in administrative operations areas as well as in professional areas.

MANUAL OF THE MEDICAL DEPARTMENT

Recent changes to MANMED of concern to the Dental Corps are summarized as follows:

Change 49—17 February 1969

This change:

1. Updates 6–47 on responsibilities of directors of dental activities and district dental officers.

2. Updates 6–149 on principal reports required from dental facilities.

3. In 6–150, Dental Service Report, DD Form 477, incorporates additional preparation information and instructions. (These changes became effective with the quarterly report for April, May, June 1969.)

4. Deletes from Chapter 6, the Section XXVI on Dental Corps of the Naval Reserve; information on the subject is in BUPERS Manual and current directives.

5. Changes; 16–14(2) and (3) to require that the Dental Record (SF 603) be forwarded to BUMED when a member is released to inactive duty.

Change 50—30 April 1969

This change:

In Chapter 6, Dental Corps, updates:

1. 6–32, Knowledge of Official Directives.

2. 6–33, Publication of Professional Articles.

3. Section VIII, Dental Technicians.

4. Section X, Civilian Employees in Dental Facilities.

5. Section XIV, Dental Examination and Treatment. (In particular 6–101(3) incorporating provisions of BUMEDINST 6150.27 which will be canceled on color coding Dental Folder to show member's dental classification; and 6–102(2) on orthodontic treatment.)

6. Section XVII, Dental Research.

7. Section XIX, Naval Dental Technicians Schools.

8. Section XX, Publications and Files in Dental Facilities.

Holders of the Manual of the Medical Department should make certain that these changes have been received.

The proper procedure for requesting any Manual or Change is contained in NAVREGS, Article 1607.3 and BUMEDINST 5215.4 series. Manuals and Changes are addressed to Commanding Officers, who are responsible for proper assignment of copies. Dental officers should not directly request any Manual or Change.

ANNUAL AUDIT OF DENTAL RECORDS

Dental officers are required to take the following action incident to the annual verification of military records during September:

1. Insure that there is a Dental Record on board for each officer and enlisted member.

2. Verify the data contained in the records.

3. Screen out all Dental Records of former crew members.

(a) Forward such records to the Member's next duty station, if known; otherwise submit these records to BUMED (Code 3342–2).

(b) Prior to mailing, check all records for inclusion and legibility of name and military service number.

4. If a record is missing or lost, comply with the provisions of MANMED article 16–27.

PROFESSIONAL RELATIONS PROGRAM

CANADIANS VISIT NAVAL DENTAL SCHOOL

Thirty-three second lieutenants of the Royal Canadian Dental Corps, in the third phase of the Dental Officer Training Program at Base Borden, recently visited the Naval Dental School, Bethesda, Maryland. On a one-week tour to observe the operation of U.S. Federal dental services in the Washington, D.C. area, the group also visited Walter Reed Army Institute of Dental Research, Armed Forces Institute of Pathology, and National Institutes of Health.

The Naval Dental School was included in the tour because the Royal Canadian Dental Corps and the U.S. Naval Dental Corps have maintained close liaison for many years. Since the 1940's nearly 100 Canadian dental officers have attended courses in residence at the School and there are always about 35 enrolled in professional correspondence courses.

JOINT DENTAL MEETING

The Dental Department, Naval Air Station, Lemoore, California, hosted the Tulare-Kings Counties Dental Society. CAPT V. R. McAtee, DC USN, is the Senior Dental Officer and Doctor Richard Kindy, Visalia, California, is President of the Society.

TWO MICRONESIAN STUDENTS COMPLETE COURSE AT THE U.S. NAVAL DENTAL CLINIC—GUAM

Bernhart Ngirablosech, Ngaraard Village, Palau, and Juan Sablan Reyes, Chalan Kanoa, Saipan, have successfully completed a nine months' course of instruction in dental prosthetic technology at the Naval Dental Clinic, Guam. Both students will return to duty in two of the six dental clinics in the Trust Territories.

ARTICLES AND ABSTRACTS

PULPAL THERAPY FOR PRIMARY TEETH

R.E. Corpron, J Mich Dent Assn 50: 341-346, Nov 1968.

In this review of the literature the three most frequently used types of treatment for pulpally involved primary teeth—direct pulp capping, indirect pulp capping, and "formocresol pulpotomy"—are described and evaluated.

The review states that direct pulp capping is useful for accidental operative exposures in all vital primary teeth, including anterior teeth in which exposures

occur during attempts at indirect pulp capping. A calcium hydroxide pulp capping agent is applied before the base and restoration are placed. Direct pulp capping is said to enjoy a 70% to 85% success rate. Indirect pulp capping is suitable for primary teeth that exhibit small carious exposures roentgenographically. A thin layer (1/2–1 mm) of carious dentin is allowed to remain over the suspected exposure site. A calcium hydroxide pulp capping agent (Dycal, Hydrex, or reagent grade calcium hydroxide) is applied to the dentin, and a zinc phosphate base is placed over the capping material before the tooth is restored. This procedure is reported to be 85% to 99% successful. The procedure that the author terms "formocresol pulpotomy" is indicated for extensive carious exposures or for accidental exposures during attempted pulp capping in primary molars and cuspids. The coronal pulp is amputed, and the remaining pulp stumps are treated by the 5-minute application of cotton pellets moistened with formocresol. A thick paste of zinc oxide, eugenol, and formocresol is then placed over the pulp stumps, the cavity is filled with zinc phosphate cement, and the tooth is restored. Full coverage with a stainless steel crown is recommended. The formocresol pulpotomy is reported to have a 90% to 95% success rate. Local anesthesia and isolation of the involved tooth with a rubber dam are required for all these procedures.

(Abstracted by: CDR Edward M. Osetek, DC USN.)

WHAT IS THE SIGNIFICANCE OF THE LEUKOCYTE COUNT

Daniel G. Walker, J Oral Surg 27(6): 431, June 1969.

Since the complete blood count (CBC) is a routine admitting procedure in practically all hospitals and in most hospitals it includes a hemoglobin, hematocrit, and leukocyte count with a differential, it is imperative that the oral surgeon have a working knowledge of the significance of these laboratory studies when they are reported.[1]

The leukocyte count is probably one of the more valuable parts of the laboratory evaluation of the patient, although there may be errors in determining the total leukocyte count, varying from 7% to 20%. Appropriate corrections usually are made by the laboratory technician.

C.S. Hardison[2] pointed out that the appropriate corrections also must be made when nucleated erythrocytes are present in considerable number because the nuclei of these cells are not lysed by leukocyte-dilution fluids. Counts made on capillary blood may be higher by 1,000 to 1,500/cu mm than those made on venous blood. This probably is due to local stasis of leukocytes. Differential count of leukocytes is absolutely essential for proper interpretation of the total leukocyte count.

The white blood cell count (WBC) is high shortly after birth, fluctuates considerably in infancy and early childhood, and reaches lower adult values in the late teens. Fluctuations occur from day to day and also during the day, and the count is highest in the afternoon. Of the normal adult population, 95% has a leukocyte count of 5,000 to 10,000/cu mm, whereas the remaining normal adults have a WBC ranging from 10,000 to 15,000/cu mm or from 3,000 to 5,000/cu mm.

Leukocytes move constantly from the venous sinusoids, spleen, marrow and other organs to the lymphatic circulation and bloodstream, and a large number may be returned rapidly to circulation on demand. For example, a leukocyte count of 35,000/cu mm has been reported after a quarter-mile run. Such responses are attributed to release of corticosteroids from the adrenal cortex after stress. Leukocytosis occurs by a similar mechanism after convulsive seizures, epinephrine administration, paroxysmal tachycardia, pain, anxiety, ether anesthesia, pregnancy, labor, heat, and intense solar radiation. Lack of leukocytic response to stress in an aged or debilitated patient is a poor prognostic sign, and administration of corticosteroids may so alter the leukocytic response that serious diagnostic errors result. Leukocytosis may be caused by infections, especially with pyogenic bacteria, infarction or necrosis of tissue, collagen disease, and hemolysis. Neoplasms which may elevate the leukocyte count include carcinoma and lymphoma. In untreated chronic leukemia the leukocyte count may be very high, whereas in acute leukemia the count often is high but is normal or decreased in 23% of patients. Intoxication from drugs and chemicals is a less common cause of leukocytosis. Acute hemorrhage may be accompanied by decided leukocytosis with a leukemoid reaction being found on differential count of leukocytes.

1. Freundlich, M.H., and Gerarde, H. W. A new, automatic disposable system for blood counts and hemoglobin. Blood: 648, May 1963.

2. Hardison, C.S. The leukocyte count. JAMA 204:377, April 29, 1968.

Leukopenia occurs as a result of diminished production of leukocytes, increased rate of destruction, or sequestration in various organs and tissues. Decreased production is associated with deficiency of vitamin B_{12} or folic acid or with bone marrow damage caused by a variety of agents including radiation, metabolic antagonists, drugs, chemicals, and bone marrow replacement. Leukopenia associated with splenomegaly sometimes is cured by splenectomy, although the mechanism by which the enlarged spleen produces leukopenia is uncertain. Infections that cause leukopenia include brucellosis, typhoid, acute viral and protozoan infections, and overwhelming bacterial infections including septicemia. The neutropenia that occurs with anaphylactic shock probably is a result of loss of leukocytes from the circulation and sequestration in various tissues. Other types of leukopenia include acute leukemia and disseminated lupus erythematosus.

In summary, accurate determination of the leukocyte count may provide useful clinical information. Its proper evaluation requires an accompanying differential count of white blood cells so that the various types and numbers of white cells present may be identified.

NURSE CORPS SECTION

ASSISTING APHASIC PATIENTS WITH SPEECH REHABILITATION

The following article by LCDR Barbara E. Miller, NC USN, was first published in the May 1969 issue of the American Journal of Nursing. It describes how the nurse can evaluate and help the aphasic patient in the absence of a speech pathologist or therapist. LCDR Miller is assigned to the Naval Hospital, Philadelphia.

Many nurses claim that they know little or nothing about aphasia, and have never participated in any techniques for speech rehabilitation. This is rarely true. Most of us have utilized techniques of speech reeducation, but often have not recognized them as such.

We have all tested a patient's level of comprehension by such methods as asking him to point to his nose, his ear, his eyes, or by instructing him to pick out specific objects from a group—a comb, a toothbrush, a pencil, a pen. We have often handed a patient a pad of paper and a pencil in order to find out whether or not he is able to write or print. This is the beginning of speech rehabilitation.

Today, there are over a million aphasic individuals in the United States. Many hospitals do not have a speech pathologist or therapist available on staff even on a consultant basis. There is no reason why the nurse cannot take an active part in speech rehabilitation for the patient with aphasia who would otherwise have no rehabilitation.

Before embarking on a speech reeducation program the nurse should discuss the situation with the patient's physician, not only for his approval to start such a program, but also to obtain from him more details of the patient's past history and diagnosis than have been recorded in his chart. He may also be able to offer some facts concerning the patient as a person prior to his illness which may be useful as the nurse progresses with the speech program.

Next, one must decide on the best approach to the patient. One approach is to express interest in helping him to improve his speech. You might explain that you wish to have short daily sessions to help him with his words and his reading.

Try not to be alarmed or discouraged if such a proposal is met with a blank stare or a burst of tears. Many patients with aphasia have experienced alterations in self-concept or even marked personality changes. They become fatigued quickly and have increased irritability, with a greater tendency to laugh or cry or to become easily upset. A patient's tears at the mention of speech retraining may be due to feelings of gratitude and appreciation, or to feelings of hopelessness and resignation. Because it may not be possible to interpret this behavior, the nurse may find herself in a very uncomfortable position. There is little to do but to disregard the outburst and let him cry it out. Leave, and return the following day. This may go on for four or five days. Eventually the patient will retain his composure and be ready for the first session of training.

The training sessions should be arranged early in the day when both patient and nurse are rested and at their best. Try to have the sessions at the same time each day and remember to keep them short. Five, 10, or 15 minutes a day are long enough. The

time span will depend on the patient, but short daily sessions are much more effective than a one-hour period once a week.

Select a specific place to work that is well-lighted, quiet, and free from disturbance. Make sure there is ample space to work and that the patient is comfortable before the session begins. There should be no one in the room other than the nurse and the patient. Family or staff members may want to observe, but this should not be allowed until the nurse and the patient have established good rapport, and then only with the patient's permission.

Evaluation Techniques

In the beginning it is necessary to evaluate the aphasia defect—to determine how much the patient comprehends. Does he recognize objects? Does he understand the spoken or written word? Remember in such testing not to give hints which may make the answer obvious. For instance, if you tell the patient to "sit on the chair," do not hold out the chair or nod to it. If you ask the patient to pick up an object, do not point to it.

There are several ways to evaluate a patient's comprehension:

1. Give the patient a simple command: "Point to your nose," "Close your eyes," "Raise your right hand." If the patient does this well, you can assume that he can understand a simple command. However, if you say, "Point to your nose," and he responds by pointing to his ear, this would indicate that he only comprehends half of the command. He knows that you want him to "point" but he did not receive the latter part of the command.

2. If a simple command is understood, then a double command might be given. For example: "Raise your right hand and place it on your head." If the patient raises his right hand and stops, this might reveal that a double command is too much for his comprehension at this time.

3. To evaluate a patient's ability in visual recognition, the nurse may lay out three or four items on the table—a comb, a pencil, a key, a coin—and then instruct him to point to the object she names. As she says the name of the object, she may also show him the printed word which he may recognize by sight and respond to.

4. Test the patient's ability to read and comprehend written instructions such as, "Hand me the book," or "Close your eyes." He must actually carry out the written or printed command without being given other cues or hints.

Apparent lack of understanding of the spoken or written word, or inability to recognize objects usually indicates that the person has a receptive aphasia.

Whether or not the patient appears to understand and respond to written, spoken, or visual stimuli, the nurse may continue the evaluation as follows:

1. Ask the patient to count from one through 10, and to name the days of the week or the months of the year. If the patient does this easily but, for example, he is not able to count or to name the days of the week in reverse order, or to count by twos or by fives, he may be using a form of automatic speech rather than a thought process. Other manifestations of automatic speech are the spontaneous and often repetitive use of such speech forms as profanity, interjections, or exclamations.

2. Instruct the patient to tell time using a clock or a watch. A large cardboard clockface may be improvised.

3. Have the patient count money and make change.

4. Find out whether the patient can write and spell.

If the patient has difficulty writing, spelling, telling time, or counting, it may indicate that he has expressive aphasia. If he appears to have equal difficulty in speaking, understanding, and writing, he may have a combination expressive-receptive aphasia.

Following the evaluation, there is no set course to follow, as no two individuals will show exactly the same defects. Almost all aphasic patients have a combination of defects. The performance and comprehension level of the patient will be a guide when selecting the beginning exercises.

An individual with receptive aphasia, expressive aphasia, or expressive-receptive aphasia will need auditory training to recover the ability to recognize and comprehend individual sounds, words, and sentences.

Auditory Retraining

The use of gestures and imitation is an effective method of assisting the aphasic patient to relearn sounds and language. Often, the aphasic patient can already imitate movements of the mouth and produce sounds. In such cases, the patient can start learning full words by repeating them after the nurse: up-down; come-go; in-out; open-close; read-write; yes-no. Saying the words to the patient slowly, one at a time, and pantomiming the action as you say them will reinforce the sound pattern.

Another method used in auditory retraining involves object and word association. Select objects used in daily living—comb, toothbrush, pencil, pen, knife, fork, bread, butter, apple, orange. Obtain pictures of each article—cut from magazines, for example—and paste them on separate cards. Print each of the words on separate cards also. Or, training kits containing words and pictures may be purchased if desired. When possible, it is useful to have the real object on hand to use along with the picture and word cards.

The words and corresponding pictures should be grouped together in separate units of related items such as clothing, food, or furniture. Use one group of words at a time and avoid confusing the patient with too many words at once. Perhaps it is sufficient to use only two or three words in the beginning sessions and, then, as the patient progresses to add selected words and pictures.

There are many ways to use these cards. You may start by instructing the patient to match the word cards with the picture cards. The procedure may then be reversed so that the patient places the correct picture with the word shown. He may also be instructed to point to the correct picture.

Another technique may be to hold out the picture and word and say, "This is a cup." Then ask the patient to write or print the word "cup." If the patient is unable to print the word himself, he could practice tracing it.

As the patient progresses in the matching of words and pictures, you may also say the word and ask him to repeat it after you. Do not be concerned with perfect pronunciation. It will improve slowly with practice.

The sessions may be made more complex by utilizing more words and pictures. Later, short phrases and commands may be presented, as well as exercises in writing, spelling, and arithmetic.

Interest may be maintained and feelings of failure avoided by selecting exercises which are not only appropriate for the needs of the patient, but also have personal appeal. Variety is important both in the techniques used and the exercises selected, because of the necessary repetition, which must be carried out in each daily session to reinforce learning.

Two other types of aphasia which are often seen in the general hospital are motor aphasia and dysarthria. With motor aphasia, the patient is unable to combine speech sounds into words and syllables, even though he still has the ability to recall words. Dysarthria is the inability to pronounce or articulate accurately due to a lack of muscle control. Frequently, patients with dysarthria also have dfficulty chewing and swallowing food, due to lack of muscle control.

Speech Retraining

The exercises just described may be used to assist the motor aphasic and the dysarthric with speech retraining. It may be helpful at first to give this patient a few simple tongue and lip exercises. These might include moving the tongue from cheek to cheek, and up and down, and pursing the lips as in whistling and blowing.

If the patient is able to make any sounds at all, they may be used in the beginning to give him a feeling of accomplishment. Work on one consonant sound or one vowel sound at a time. Show the patient how the tongue and lips are used when making each sound. A large mirror helps him watch what he is doing with his tongue and lips. The nurse may demonstrate the sound several times at first, then have the patient join in.

Sound drills may be given next. Initially, these words should be limited to a single vowel and consonant sound. More difficult and complex sounds may be added as the patient progresses. Examples of beginning word drills which may be used are as follows:

—may - me - my - mow - moo
—bat - cat - hat - mat - rat
—cot - hot - rot - pot
—hoot - boot - root - toot

When individual words can be produced well, reading drills may be started. Short sentences emphasizing particular sounds should be constructed for the patient's exercise drill. Then, familiar phrases such as "Hello," "How are you?" "I am fine" and "Good morning" should be used.

Later on, as more extensive reading material is needed, find out if the patient has a hobby or a particular interest in current events, history, or sports. Reading material selected according to his interests will provide much more motivation than material which is unfamiliar or of little interest.

Speech retraining is often a long and repetitious process that requires patience and persistence on the part of both the patient and his helper—family member, speech therapist, or nurse.

The success of a retraining program depends on many factors. For example, a great deal depends on

the nurse's approach to the patient, the length of each session and the time of day it is conducted, the techniques and exercises utilized, and the variations in the presentations. Being consistent, striving to help the patient develop confidence in his own ability, and ending each session with an exercise that the patient can do well allows him to leave each practice period with a feeling of success so necessary for maintaining the will to learn to speak again.

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AEROSPACE MEDICINE SECTION

HIGHLIGHTS FROM THE 40TH ANNUAL MEETING OF THE AEROSPACE MEDICAL ASSOCIATION CONVENTION

This year's meeting was held in the San Francisco Hilton from 5 through 8 May and was heavily attended by Navy aerospace military and civilian personnel. The following highlights are noted for this issue of the U.S. Navy Medical News Letter.

Naval Aviation Medicine Luncheon

The Annual Naval Aviation Medicine Luncheon was held on 5 May 1969. CAPT L.P. Jahnke, MC USN, Assistant Chief for Aerospace Medicine, Bureau of Medicine and Surgery, Navy Department, Washington, D.C., served as Master of Ceremonies and presented an Overview of Naval Aerospace Medicine. His remarks also included career planning for flight surgeons and the vital role the senior officers play in motivating the junior officers toward a career in the Naval Medical Corps.

Among the approximate 200 in attendance at the luncheon were naval flight surgeons, aerospace physiologists, and aerospace experimental psychologists from the Bureau of Medicine and Surgery and numerous activities in the field. Special guests included RADM Herbert H. Eighmy, MC USN, Commanding Officer of the Naval Aerospace Medical Center, RADM Frank B. Voris, MC USN, Assistant Chief for Research and Military Medical Specialties, Bureau of Medicine and Surgery, and RADM Leo McCudden, USN, Commandant, 12th Naval District.

Navy Medical Officer President-Elect of Aerospace Medical Association

CAPT Ralph L. Christy, MC USN was elected to the office of President of the Association. He will succeed Doctor Charles Berry of the National Aeronautics and Space Administration who is President for the forthcoming year. CAPT Christy is presently assigned to the Bureau of Medicine and Surgery, Navy Department, Washington, D.C. He has been a member of the Association for over 24 years, has presented papers at previous meetings, and has been active in the Association in a variety of ways.

Doctor Christy was Chairman of the Program Committee for the 1963 meeting and served for the next four years on the Executive Council as an elected member and as President of the Space Medicine Branch. He also served on the Executive Committee of the Association the last three of those four years. He was elected as a Fellow in the Association in 1950 and is a past recipient of the Eric Liljencrantz Award for his contributions to the solution of acceleration and high altitude problems.

Doctor Christy was assigned as the medical officer in the development of the world's largest human centrifuge in the late 1940's. Use of this centrifuge has resulted in many contributions to military and civilian aerospace medicine, and it was used in the training of the X-15 pilots and the Mercury and Gemini astronauts. He has also made contributions in other areas, such as in the development of the full pressure suit, supine seat, ejection seat, and noise protective equipment.

CAPT Christy received his M.D. degree from the University of Colorado School of Medicine in 1940. He is Board Certified in Aerospace Medicine, and is a member of the Committee on Aerospace Medicine of the Council on Occupational Health of the American Medical Association.

New President, Space Medicine Branch, Aerospace Medical Association

CAPT Frank H. Austin, Jr., MC USN, now serving as Head, Life Sciences Department, Naval Safety Center, Norfolk, Virginia, assumed the position as President of the Space Medicine Branch of the Aerospace Medical Association.

Doctor Austin is a naval aviator as well as a flight surgeon and has participated in many important research and development projects and assignments, including flight testing of the full pressure suit. He also participated in biomedical monitoring studies of pilots operating aboard carriers in the Vietnam area.

Doctor Austin was elected as a member of the Executive Council of the Aerospace Medical Association in 1968. He is a member of long standing and was elected a Fellow of the Association in 1960. He was the first recipient of the Julian E. Ward Memorial Award in 1963, which is given annually for superior performance and outstanding achievement in aerospace medicine during residency training. He is Board Certified in Aerospace Medicine.

Woman Officer Honored

CAPT Mary F. Keener, MSC USN was elected a Fellow in Aviation Medicine during the Annual Meeting. This was the first time in the history of the organization that a woman has been so honored. The Constitution of the Aerospace Medical Association provides that not more than 15 Fellows in Aviation Medicine shall be elected in any year. All elections are by a group of Fellows from among the Associate Fellows and members who have made outstanding contributions to Aviation Medicine.

CAPT Keener is Chief Aerospace Physiologist of the Navy, holding Designation Number 1. In her present assignment she is Head of the Aerospace Physiology Training Branch and Head of the Aerospace Physiology Systems Requirements Section, Bureau of Medicine and Surgery, Navy Department, Washington, D.C. In these capacities she plans, directs and coordinates the Aerospace Physiology Training Program for Naval Aviation personnel. She has additional duty as Head, Physiological Training Device Requirements Section, Office of the Chief of Naval Operations, Navy Department, Washington, D.C.

CAPT Keener was the first woman officer to attain the rank of captain in the Medical Service Corps, United States Navy. She was a Vice President and member of the Association Executive Council for two years.

Navy Medical Corps Officer Honored

CAPT Roger G. Ireland, MC USN, Director, Crew Systems Division, Naval Air Systems Command, and Head, Aerospace Medicine Equipment Branch, Bureau of Medicine and Surgery, Navy Department, Washington, D.C., received the Eric Liljencrantz Award while in attendance at the meeting.

This Award was established in memory of CDR Eric Liljencrantz, MC USN, whose brilliant career in Aviation Medicine was cut short by his death in an airplane accident in 1942.

Doctor Ireland was cited for his outstanding contributions to Aerospace Medicine in the areas of altitude and acceleration stress and for his many years of consistent and conscientious efforts toward improving the lot of Naval and Marine Corps operational aircrew personnel. Doctor Ireland's broad personal experience in the flight environment, including personal investigations in the forward combat areas in Vietnam, and his familiarity with the aircrewman's personal survival equipment needs have enabled him to effectively help guide the Navy's research and development efforts toward solution of a number of difficult problems in this area of support.

Doctor Ireland is a member of the American Medical Association, the Association of Military Surgeons of the United States, a Fellow in Aviation Medicine, Aerospace Medical Association, and a member of the Aerospace Medical Advisory Panel of the Advisory Group for Aeronautical Research and Development of the North Atlantic Treaty Organization. He is Board Certified in Aerospace Medicine. —AeroMed, BuMed.

NEWS FROM OUR FLIGHT SURGEONS "ACADEMY"

A number of notable events are reported from the Naval Aerospace Medical Center at Pensacola, Florida this past summer.

Changes of Command

RADM Herbert H. Eighmy, MC USN was relieved as Commanding Officer of the Center on 30 June 1969 by RADM Edward P. Irons, MC USN. ADM Eighmy, who has commanded NAMC for the past 3 years has been named Administrator of the Specialty Care Center at the Pensacola Baptist Hospital.

Upon retirement in July, RADM Eighmy will assume his new civilian duties. He will direct the several functions in the newly purchased Specialty Care Center across Moreno Street from the main hospital. These functions include extended care programs, psychiatric care, and rehabilitation service programs.

A veteran of over 30 years service, he started his

naval career in 1936 as lieutenant (jg) in the Medical Corps, advancing to his present rank in 1964.

His present tour in Pensacola is his third. The first was in 1941 when he was a student flight surgeon. Upon completion of his training he was designated as Naval Flight Surgeon #35. His second tour here was in 1960. This time he was commanding officer of the Naval Hospital and Deputy, Naval Aviation Medical Center. This duty was followed by assignments to Annapolis, Maryland and Washington, D.C.

In June 1966 he returned to Pensacola as Commanding Officer, Naval Aerospace Medical Center, with additional duty as Chief of Naval Air Training Staff Medical Officer. On 15 June 1969, Admiral Eighmy received an honorary doctorate from his Alma Mater, Allegheny College in Pennsylvania.

ADM Irons, who had commanded the Naval Hospital in Oakland, California since July 1967, a native of Illinois, was commissioned in the Medical Corps in 1939 and was designated a naval flight surgeon in 1941. He was also Commanding Officer of the Naval Hospital at Yokosuka, Japan in 1965 and 1966. He and his wife have 3 children.

The following day, 1 July 1969, CAPT Joseph W. Weaver, MC USN, Commanding Officer of the Naval Aerospace Medical Institute, was relieved by CAPT Marvin D. Courtney, MC USN. CAPT Courtney had been Director of the Aerospace Medicine Technical Division in the Bureau of Medicine and Surgery, Washington, D.C. since July 1965, with additional duty to the Staff of Deputy Chief of Naval Operations for Air. He was relieved in Washington by CAPT Roger G. Ireland, MC USN.

CAPT Weaver, Commanding Officer at the Institute since April 1967, has been assigned to COMNAVAIRPAC as Staff Medical Officer.

Residents in Aerospace Medicine

Six senior Navy medical officers left Pensacola July 1 with certificates to show they had completed two years of residency training in Aerospace Medicine at the Naval Aerospace Medical Institute.

Each of the doctors is an experienced Naval Flight Surgeon. In addition to the baccalaureate and Doctor of Medicine degrees, each one has been required to obtain a Master of Public Health degree recently. These qualifications and the two years of residency training at the Institute enable the doctors to take the examinations given by the American Board of Preventive Medicine in the subspecialty of Aerospace Medicine. All completed the three-day examination in May.

CAPT Paul C. Gregg has been assigned to NAS, Corpus Christi, Texas. The other five doctors left for assignments as senior medical officers aboard aircraft carriers: CDR Donald R. Hauler, ENTERPRISE, CVAN-65; LCDR Clyde C. Jeffrey, Jr., FORRESTAL, CVA-59; CDR George W. Mathews, Jr., RANGER, CVA-61; CDR William W. Simmons, CONSTELLATION, CVA-64; and CDR Theodore J. Trumble, JOHN F. KENNEDY, CVA-67.

Their places were taken on 30 June 1969 by seven Navy Flight Surgeons who reported to NAMI to start their final two years of residency training leading to certification in Aerospace Medicine. These physicians have all just completed a year of academic work and have been awarded a Master's degree in Public Health. Their names and the School from which they received the degree are as follows:

CDR Elihu York	Harvard
CDR Harold M. Braswell, Jr.	Tulane
CDR Larry R. Fout	Tulane
LCDR George M. Stone, II	Tulane
LCDR Daniel B. Lestage	Tulane
LCDR Charles H. Bercier, Jr.	Tulane
LCDR John A. Calcagni	Rochester

Flight Surgeon Classes Graduate

Sixty flight surgeons of Class 120, the largest class in the 29-year history of the Naval Aerospace Medical Institute, received their certificates at graduation ceremonies conducted by CAPT J.W. Weaver, held at the Auditorium, Building 633, April 3. RADM H.H. Eighmy made the presentations.

Graduating along with the flight surgeons were seven aerospace physiologists and one experimental psychologist. LT David H. Gundy of Rye, New York was the recipient of the Navy Surgeon General's Award for his academic and leadership achievement during the six-month course of instruction in Aerospace Medicine.

The guest speaker, CAPT Silas R. Johnson, NAS Commanding Officer, told the graduates of the uniqueness of their Navy Profession, "The single thing that I believe separates the Navy from other professions of our society is accountability. . .with authority goes responsibility, and with them both, accountability." Continuing, he offered one word of advice, saying, "You cannot perform the somewhat awesome duties and responsibilities assigned you without getting involved professionally, socially, and in all aspects of the command to which you are assigned."

As a parting thought, he exhorted the graduates to take good care of our country's defenders, "be they jet jockeys, spad drivers, or whirly-bird riders."

The graduates' wives, relatives, and friends attended the graduation.

Marine COL Donald Conroy, recipient of five Distinguished Flying Crosses and 27 other awards, was commencement speaker on 19 June 1969 when Student Flight Surgeon Class 121 graduated from the Naval Aerospace Medical Institute, Pensacola. Thirty-one medical officers were given their designation as Naval Flight Surgeons and received their wings of gold. Included in this class were four foreign students representing the Brazilian, Peruvian, Indonesian, and French Navies:

LT J.J. Damasceno, MC	Brazilian Navy
LT F. Maestre, MC	Peruvian Navy
LT Soerasto, MC	Indonesian Navy
LT(JG) J.P. Trabaud, MC	French Navy

Also graduating on 19 June and receiving their wings were three Aerospace Physiologists and one Aerospace Experimental Psychologist.

LT David G. Kemp received from RADM H.H. Eighmy the Navy Surgeon General Award as the outstanding graduate in Flight Surgeon Class 121. Son of the C. Donald Kemps of Perryburg, Ohio, Doctor Kemp received his B.S. degree at the University of Toledo, and his M.D. from Washington University Medical School, St. Louis, Mo. He has been transferred to Whidbey Island, Washington for duty with Heavy Attack Squadron 123.

Flight Surgeon Works for Aviator's Wings

Each year the Navy selects one flight surgeon to go through flight training and win his "Wings of Gold." LCDR Axel F. Campbell was selected into the flight program in February 1969. During his early training, he achieved the highest flight grade ever attained at Saufley (3.82), and was selected as a Student of the Week. Now at Training Squadron Seven, NAS Meridian, he is maintaining the same excellent standards, as he completed transition stage in 8 flying days with an average grade of 3.48.

The Navy has an allowance of 20 officers holding dual-designators as flight surgeon/aviator. They are assigned to special research-oriented billets where a knowledge of aviation and medicine is necessary. LCDR Campbell already has a background in both. His father is a physician in Chile and the naval officer graduated from the University of Chile and served his internship at the University of Washington. He had been flying for almost ten years and holds private pilot, commercial and instructor licenses.

Upon entering the Navy in July 1964, LCDR Campbell was assigned as General Medical Officer at the San Diego Marine Corps Recruit Depot. Two years later he changed to a reserve unit (Naval Reserve Medical Company 11–6) while serving a two-year residency in internal medicine. Then in November 1967, he returned to active duty as a student flight surgeon. On completion of this training, he was assigned as Senior Medical Officer aboard the USS RANDOLPH with deployments to the Caribbean and South America. When accepted into the flight program, LCDR Campbell was serving as Staff Medical Officer and flight surgeon for Command Naval Air Pacific and VC-3, North Island, San Diego. He is a member of the American Medical and Aerospace Medical Associations.

Army Navy Conference for Flight Medical Research

The Sixth Joint Army-Navy Conference for Flight Medical Research was held at the Navy Aerospace Medical Institute, Pensacola, Florida 18-19 June 1969. RADM Frank B. Voris, MC USN and members of the Research Division attended the conference. Army, Navy, and civilian speakers participated in the conference and panel discussions of research matters pertaining to stresses and strains encountered by flyers in both inner and outer space.—AeroMed, BuMed.

HELICOPTER PERSONNEL ESCAPE, PROTECTION AND SURVIVAL SYSTEM

The following is abstracted from an article by F.T. Thomasson, U.S. Naval Air Systems Command Headquarters.

The United States Navy has recently proved the technical feasibility of a "fuselage capsule" as a means to save helicopter occupants following in-flight emergencies by actual in-flight initiations of a system installed in drone helicopters. This effort was undertaken as a result of a study of Navy fatal and critical injury accidents which concluded that 56% of the fatal injuries could have been prevented by use of an in-flight escape system and that an additional 25% of

the fatalities and the majority of the critical injuries would have been precluded if other protective means such as fire and impact protection and emergency flotation had been available. This study is herein discussed from several aspects.

Since the early days of military flying, methods for in-flight escape from disabled aircraft have been considered and developed, keeping pace with the improved performance and the increasingly hazardous missions of the combat aircraft. These methods range from personal parachutes and early ejection seats through fully automatic ejection seats to the recent sophisticated escape capsule system installed in the F–111 aircraft.

The sole exception to this progressive development is the helicopter. During development of the helicopter, no special provision for in-flight escape from helicopters has been seriously considered. This probably has been due to the following factors:

1. The autorotational capability of the helicopter, permitting power-off, steep gradient spot landings, instills in the pilot confidence in his ability to cope with in-flight emergency situations.

2. Mistrust of the effectiveness of personnel parachutes, because the unstable nature of the aircraft and the close proximity of the whirling rotor blades would hinder egress and preclude successful bailout during helicopter in-flight emergency situations.

3. The low altitudes flown as compared to fixed-wing operations. (This may be both a cause and effect of the preceding items. For example, lack of parachutes encourages lowflying to permit quick landing in the event of trouble; low flying rules out the use of personnel parachutes. In addition, of course, certain missions demand low altitude flight.)

4. The inconvenience of wearing a parachute.

5. The complexity and weight of ejection seats coupled with the problem of avoiding the rotor blades during ejection.

In Southeast Asia the helicopter has "come of age" as a combat vehicle. It has established its worth as an extremely important and integral part of limited war combat operations by its successful employment in close-in attack and patrol missions, vertical envelopment operations and in dramatic rescue operations in hostile territory. However, these types of missions have naturally led to increased exposure to enemy attack by ground fire to which, because of the low and slowflight profiles, the helicopter is particularly vulnerable. Compared to personnel flying fixed wing aircraft on similar close-in support missions, the helicopter aircrew has virtually no survival protection.

The In-Flight Escape Problem

By virtue of changes in missions, the autorotative maneuver is becoming less reliable as a means to neutralize the personnel hazards associated with in-flight emergencies, particularly at low altitudes. Successful autorotation requires hundreds of feet of altitude to insure sufficient lift from the rotors and a visual ground reference to select suitable landing terrain and accomplish the flare maneuver to arrest the rate of descent just prior to touchdown. But the requirement for increased speed and higher payload capability has necessitated advanced blade design and resulted in higher blade loadings, both of which dictate an increase in the altitude required for accomplishment of the autorotative maneuver. This increased altitude required for autorotation is in direct opposition to the low altitude flight profiles being flown. As the helicopter has become a combat vehicle, battle damage to the critical parts (that is, blades, transmission, etc.) required for successful autorotation is highly probable. These factors combine to make very hazardous reliance on autorotation as the sole means of combating an in-flight emergency.

The Additional Survival Problem

Helicopters do not afford adequate protection from crash impacts, fires or ditchings. The crew seats are designed for 10 g's and troop seats designed for less. The armor protection hurriedly added as a result of early combat losses to protect the occupant from ground fire may actually reduce his capability to survive a crash because the added weight of armor. Accomplished without a commensurate strengthening of the seat support structure, it has reduced the impact "g" tolerance of the seat by approximately one half. The present configuration of fuel cells is inadequate. While the cells have a self-sealing capacity in the lower portions, they are vulnerable to API and tracer ammunition in the upper vapor zone. The existing cells installed are easily ruptured by crash impacts and having no means of fire suppression, are susceptible to both in-flight and post crash fires.

Personnel surviving a helicopter emergency do so only when the crash impact is light, post crash fires small, or the helicopter floats for a sufficient time to permit the occupant to escape; NOT due to helicopter design. Advanced personnel safety and survival aids, required to insure injury-free survival

during emergency situations, have not substantially influenced helicopter design. It has been concluded that helicopters do not provide an acceptable level of injury-free suvival during either in-flight or crash emergencies.

The proposed Helicopter Personnel Escape Protection and Survival System will respond to this operational deficiency by providing the required capability for high survivability for personnel which does not exist in any present operational helicopter.

The Initial Study

Realizing that the foregoing was true, the U.S. Navy, in 1961 contracted for a study of helicopter accidents to document the helicopter accident picture and to provide data to guide the design of means to prevent fatal and critical injuries during helicopter accidents.[1]

From an analysis of the data on Navy helicopter accidents for the period 1952–1960, the study revealed that 90% of in-flight emergencies occurred at altitudes between 100 and 600 feet above terrain and demonstrated the urgent need for an escape system which would function at these low altitudes. It was concluded that the escape system must provide safe in-flight escape following an emergency occurring as low as 100 feet for maximum "save" capability. Based upon this 100 foot minimum altitude, it was estimated that 56% of the occupant fatalities could have survived by the use of an advanced type of in-flight escape system. An additional 25% of the fatalities were estimated to be "candidates for survival" by the use of improved crash safety and survival provisions, such as impact protection, crash-fire prevention, and emergency flotation.

The following three methods of in-flight escape were examined during the study from the aspects of performance, weight, and effect on airframe design.

1. Individual parachute and normal bailout.
2. Rototable crew ejection seats with horizontal ejection to clear rotor blades.
3. Capsule escape system.

Individual parachutes were rejected as not offering the escape performance required. Ejectable crew seats, while providing the best in-flight escape performance under most conditions, were rejected because of the weight penalty and prohibitive airframe design complication when trying to save occupants of a multi-crew/passenger vehicle.

The capsule escape system was selected as the lightest, best performing, and most efficient means of providing in-flight escape. The capsule also affords two additional meaningful benefits:

1. The passengers play a completely passive role and need do nothing to insure their survival.
2. The required crash protective and survival features can be more easily integrated into the "system" design, as applied to the complete helicopter.

A minimum escape performance altitude of 100 feet in hovering flight was determined to be feasible based in part upon advancements in pyrotechnic initiation and severance devices, but primarily upon the recent development of Ultra-Fast Opening Parachutes. These parachutes are ballistically deployed and ballistically spread; therefore, their response is rapid and their performance relatively independent of air-speed. The parachutes can be spread fully in static conditions.

Test Prototype Capsule System Design

Based upon the results of this initial study, the Navy set out to prove conclusively the feasibility of the capsule escape system. In this project, a capsule escape system was developed for, and installed, in obsolete UH-25B helicopter test vehicles configured for remote controlled flight for fullscale system testing. The feasibility of the escape capsule system was proved by three successful in-flight initiations of the system during March-June 1966. The details of the development of the over-all system and of the recovery sub-system are discussed elsewhere.[2,3]

During the drone tests, the UH-25B system was initiated from a single source and the explosive energy was transferred by Confined Detonating Cord (CDC) to simultaneously initiate the rotor blade jettisoning and the fuselage severance devices. It is specifically emphasized that these assemblies were structurally intact (no disconnects) and were severed by linear shaped charge and other explosive devices. Separation rockets were ignited to insure rapid, positive jettisoning of the unoccupied rear section from the inhabited portion or capsule and the rotor blades departed the area. After a 0.6 second delay to insure a clear area, four 35-foot diameter parachutes were ballistically deployed and ballistically spread to recover the capsule.

Capsule Feasibility Test Program Summary

Four drone tests were conducted and the system was successfully initiated in three. The initial test attempted was aborted due to drone control difficulties. Following is a summary of the results of each test. Detailed results are recorded elsewhere.[2]

Test No. 2—This test, conducted on March 31, 1966, was completely successful. This test was historic as the first in-flight severance of a structurally intact fuselage and recovery of a fuselage capsule. The helicopter was flying straight and level at a ground speed of 53 knots at initiation. All subsystems and components functioned correctly and the capsule was recovered by the parachutes, at a survivable rate of descent of 31 fps, 74 feet below the point of initiation. The sequence from initiation to recovery required only 2.7 seconds. The capsule impacted on external energy attenuators (trusgrid honeycomb absorber pads) at a level of 35 g's.

The absorbers were very effective and attenuated the impact from an expected level of greater than 150 "g's" to 35 "g's" and greatly reduced the all-important "g" onset rate and eliminated "g" rebound. This great reduction in impact loads due to the pads made further attenuation to acceptable physiological tolerances within the capability of energy absorbing troop seats. The experimental troop seat having energy attenuating capabilities was installed in the capsule and functioned properly to reduce the impact on the 225 pound antropomorphic dummy to a survivable 20 "g's."

Test No. 3—This was also successful but a very interesting malfunction occurred. The system was initiated with the helicopter in a 40 degree dive and a ground speed of 26 knots in order to demonstrate the capability of the separation rockets to provide clean separation between the jettisoned aft fuselage section and the capsule under dive conditions. Attainment of a survival rate of descent of 45 fps was accomplished 143 feet below the system initiation altitude. The forward rotor blades failed to jettison but were stopped by the parachute risers. Though the risers were shortened by being wrapped around the blades little or no effect in recovery system performance was noted. The capsule impacted at 32 fps and the impact forces were similar to those recorded on Test Number 2.

Test No. 4—This test repeated the previous successes, but another very informative malfunction occurred. The helicopter was flying at 90 knots ground speed in a shallow dive at system initiation. Recovery to a survivable rate of descent was achieved at 187 feet below the system initiation point. A riser on one of the parachutes was severed by a test fixture and the parachute was lost. However, the capsule impacted at 34 fps with results similar to those noted on Tests Nos. 2 and 3.

Tests Nos. 1 and 5—These were test failures as the system was not initiated. Drone control problems during Test No. 1 resulted in a crash of the helicopter on take-off prior to initiation of the system test. The helicopter was purposely crashed on Test No. 5 after vain attempts to initiate the capsule system.

In summary, it can be concluded that the program was successful and much useful information was learned from the failures.

The results of Tests Nos. 2-4 proved conclusively that the capsule escape system could function successfully under varying helicopter flight conditions.

The ability of the system to provide successful recovery within 100 feet of level or hovering flight was demonstrated.

The tests also demonstrated that impact forces can be attenuated to within physiological tolerances by use of external energy absorption devices and energy attenuating seats functioning in harmony with each other.

The failure of the rotor blade to jettison during Test No. 3 was traced to faulty CDC leads, as also was the failure to initiate the system on Test No. 5. These failures demonstrated the sensitivity of the CDC leads to rough handling and indicated that additional protection of these leads must be provided in an operational installation.

The safety and insensitivity of the pyrotechnic devices during a crash were demonstrated during Tests Nos. 1 and 5. Severe impacts, resulting in massive structural damage to the helicopter, did not cause detonation of any pyrotechnic devices.

The rotor blade jettison failure was informative since this proved that the ballistic deployment of the parachutes was so rapid that catastrophic parachute failure was precluded. It also demonstrated the recovery system's relative insensitivity to interference by the blades.

Survivable rate of descent with only three of the four parachutes inflated was demonstrated.

The Future Program

The U.S. Navy, supported by the U.S. Army technical personnel and numerous private contractors, is embarked upon a program to design and develop a "Helicopter Escape, Protective and Survival System" toward operational use in helicopters.

To insure the validity of the system approach selected on the basis of the study of accidents occurring

during the 1952-1960 period, a similar study was completed of all Navy and Army accidents through 1965. It can be seen that the updated statistics continue to support the requirement for means to provide in-flight escape and crash-safety provisions for helicopter occupants.

The program objective is to protect future helicopter occupants from fatal and incapacitating critical injuries despite the nature and severity of the emergency. This will be accomplished by the design of a true "system" through close integration of the various required features so that they function in harmony with each other. The "heart" of this system is the escape capsule, but the protective and survival features are an inseparable part of the system.

The following sequence is presented to illustrate the composition of the Helicopter Personnel Escape, Protective and Survival System and how it would function in operational use and apply to a large troop carrying turbine powered helicopter.

Upon recognition of the emergency, the pilot (or other crewman if the pilot is incapacitated) will initiate the system by a single action that actuates the initiation subsystem.

The initiation subsystem, composed of either detonators and Confined Detonating Cord (CDC) or a laser and fiber optic transfer network will trigger the severance, separation, and recovery subsystems automatically in the proper time sequence.

The severance subsystem, composed of Linear Shaped Charge (LSC) explosive bolts and explosively driven guillotines, will simultaneously cut the fuselage, jettison rotor blade assemblies, fuel tanks, and engine pods, as required.

The separation subsystem, composed of rockets and/or thrusters, will impart a separation velocity between the fuselage (aft section, fuel tanks, engine pods, etc., as required).

The recovery subsystem, composed of parachutes which are ballistically-deployed and ballistically-spread, and of retrorockets (used in the case of large recovered payloads), will be actuated after a time delay to insure that the jettisoned portions are clear.

The parachutes will be rapidly deployed and spread, to reduce quickly the capsule's velocity to a survivable rate of descent, or to a velocity which can be reduced to a survivable rate of descent, by the retrorocket when used. The retrorockets, used in combination with the parachutes to obtain the most efficient recovery system from weight and volume standpoints, will be initiated just prior to ground impact by a mechanical, explosive, or avionic ground sensing device.

It is at this point in the escape from an in-flight emergency situation that the protection/survival devices come into play. External energy attenuation (EA) devices in the landing gear and mounted on and/or in the fuselage operate mechanically to reduce partially the shock of the impact on the occupants.

Energy attenuating seats, protective apparel, and restraint devices, working in concert with the external EA devices, reduce the impact shock to an acceptable human tolerance level, provide restraint for the occupants and protect their heads to insure an injury-free impact.

In the event there are on-board fuel tanks, fire preventive measures (emulsified fuel and/or impenetrable fuel tanks) and fire suppressive measures (extinguishing by the automatic injection of foam or inert gas into the tanks) will preclude post-impact fires.

Automatic flotation devices and/or built-in capsule water-weight integrity will insure capsule bouyancy following water impact.

Survival equipment will be available to insure long-term survival should such be required.

The protective and/or survival features, as described, will greatly reduce the incidence of fatal and incapacitating critical injuries during emergencies initially occurring in the area below 100 feet and, therefore, beyond the capability of the in-flight escape system.

Helicopter and personnel armor has not been mentioned in this discussion but, while it does not function as a direct part of the escape capsule, it is, of course, an integrated part of the total "Helicopter Personnel Escape, Protection and Survival System" as it offers protection against the most hazardous and real threat to personnel survival in combat.

System Development Status

The reader should be quickly oriented to the state-of-development of the Helicopter Personnel Escape, Protective and Survival System and its various components. The system is actually an integration of many devices which have been under development for some years or are in operational use.

All the subsystems and/or devices are in an advanced development status with two exceptions: the

recovery system and the latest fire prevention and extinguishing devices adaptable for the system application.

Exploratory development is currently underway by the U.S. Army laboratories and civilian aircraft agencies to obtain automatic fire suppressive devices. Inert gas injection and instant foam devices are being investigated. Also, much work has been, and is being accomplished in the area of decreasing the fuel fire hazard by use of gelled and emulsified fuels.

The application of ballistic deployment and ballistic spreading to parachutes up to 72-feet in diameter has been completed and extensive developmental testing accomplished.[4] However, based upon the test results to date, increased efforts must be expeditiously undertaken to increase the operating time of these parachutes and to match their maximum deployment speed capability with the ever-increasing speeds of the latest helicopters.

Retro-rockets have been developed for a multitude of applications but are not in operational use. It is of maximum importance, in order to obtain the most efficient and lightest recovery system, that a retro-rocket system be developed for the helicopter capsule application and tested to insure that high reliability will be attained from both the sensing device and the rockets. By use of retro-rockets a very important benefit will be obtained. If the recovery system can be devised to position quickly the capsule into the retro-fire attitude, the retrorockets will provide a great amount of impact attenuation, even though the recovery parachutes have insufficient altitude to function completely. In this manner, the "no man's land" where neither the capsule nor the protective devices would be effective, estimated to be 40-100 feet above the terrain, can be eliminated.

System Impact on Helicopter Airframe Design

This paper would not be complete without a discussion of the effect of the "Helicopter Personnel Escape, Protective and Survival System" installation on the helicopter airframe configuration and gross weight.

The system installation will not require major modifications to the airframe. The capsule subsystems, with the exception of the recovery subsystem, will be composed of small, lightweight components dispersed evenly throughout the airframe. A cursory examination of the current helicopters has shown that existing voids will permit satisfactory installation of the recovery system and that the other capsule components can be easily accommodated.

The protective and survival devices can also be installed with a minimum of structural change because the largest components (i.e., energy attenuating seats and landing gear) will be replacements for currently installed items.

Thus, the preliminary conclusion has been made that, not only is the Helicopter Protection, Escape and Survival System adaptable to the majority of U.S. helicopter designs, but that retrofit is possible if certain design considerations are accepted.

Weight added to a helicopter is, of course, a prime consideration in the installation of any system. Unfortunately, as helicopters in most cases do not have even so much as a parachute installed for personnel survival, a weight penalty will result from the installation of the system. Preliminary weight estimates indicate that the complete system will increase the gross weight by 6-8%. The actual increase in gross weight is dependent upon several factors, such as weight of the helicopter, number of passengers, amount of structure which can be jettisoned and the type of recovery system used. The system weight is also influenced by a decision as to the acceptance of a higher recovery system weight in order to recover the complete fuselage and thus enabling the helicopter to be returned to service after minor repair. A reduction in recovery system weight can be achieved on the order of 40% by use of a hybrid system of parachutes and retro-rockets in lieu of an all-parachute recovery system.

The final determination as to whether or not the increase in helicopter gross weight, due to installation of the system, can be tolerated must be made on a systems effectiveness basis.

Is the degradation in mission effectiveness, by virtue of the added weight, offset by the gains in aircrew safety in terms of personnel saved, which will result from installation of the system?

Based upon the accident data, projected into future helicopter operations, it is estimated that the escape capsule will provide the bulk of the "saves" (60-65%) as it will insure injury-free survival when initiated at 100 feet in hovering flight, at lower altitudes with forward speed present, and will perform throughout the ever-increasing speed regime of the helicopter. The balance (35-40%) of these saves will result from the ability of the Protective and Survival Group to reduce the fatalities and critical injuries now occurring during crashes by attenuation of the

impact "g" levels to within human tolerance and by eliminating post-crash fires and drownings.

References

1. D. F. Thompson, "Feasibility Study of Escape Systems for U.S. Navy Helicopters." Final Report to Bureau of Naval Weapons under Contract Now 61-0668c, Boeing, Vertol Div., R-295, October 1962.
2. D. F. Thompson and R. Millington, "Helicopter Capsule Escape System." Final Report to Naval Air Systems Command under Contract Now 63-0325, Boeing, Vertol Div., D8-444, October 1966.
3. J. W. Duncan, "The Parachute System for the HUP Helicopter Escape System." Final Report to Naval Air Systems Command under Contract Now 63-0275c, Stencel Aero Engineering Corp., September 1966.
4. W. R. Peck and J. W. Duncan, "64 Foot Ultra Precision Parachute." Final Report to Naval Air Systems Command under Contract Now 64-0347f, Stencel Aero Engineering Corp., December 1966.

(Editor's Note: As of this reporting, the Navy has embarked upon an R&D program to develop a helicopter escape system at NADC, Johnsville, Pa.)

IN MEMORIAM

Navy Flight Surgeon lost in helicopter crash at sea off San Diego.

The Senior Medical Officer of the USS CONSTELLATION, CAPT Andrew W. Stevenson, Jr., MC USN, 45, and five other Navy personnel died on 13 June 1969 when a Navy helicopter ferrying a patient from the carrier to the Naval Hospital at nearby Balboa was lost at sea.

The cause of the crash of the UH2-C Seasprite is unknown. The search for survivors was conducted by two destroyers on maneuvers in the area and by four Navy helicopters from Imperial Beach, a Coast Guard helicopter, and a Navy crash boat from North Island. The bodies of the pilot and an enlisted man were picked up, the Navy reported.

CAPT Stevenson was accompanying a patient, an aviation machinist's mate, to the Naval Hospital for treatment of a compound arm fracture incurred in a flight deck accident aboard the carrier. No other medical personnel was aboard the helicopter.

A 1953 graduate of the University of Oregon Medical School, CAPT Stevenson was commissioned in the medical corps the same year. He served an internship at the Naval Hospital here and a residency at the University of California School of Public Health in Berkeley.

Prior to attending medical school, CAPT Stevenson completed flight training in 1942 and served as a naval aviator until 1947. He attended the Navy School of Aerospace Medicine and was designated as a flight surgeon in 1958. CAPT Stevenson was a diplomate of the American Board of Preventive Medicine in aerospace medicine.—U.S. Medicine, 1 July 1969.

PERSONNEL NOTES

Promotions:

Four of our flight surgeons have sewed on their fourth stripes during the summer. They are:

CAPT Arthur J. Grote, MC USN
Senior Medical Officer
Marine Corps Air Station
Beaufort, South Carolina

CAPT Louis J. Herrman, MC USN
Senior Medical Officer
Second Marine Aircraft Wing
Cherry Point, North Carolina

CAPT John C. Ralston, Jr., MC USN
Resident in Aerospace Medicine
Naval Aerospace Medical Institute
Pensacola, Florida

CAPT Kenneth Reichardt, MC USN
Senior Medical Officer
Naval Air Station
Norfolk, Virginia

The Washington Scene:

RADM Frank B. Voris, MC USN, who had been Assistant Chief, BUMED for Research and Military Medical Specialties since July 1967, departed this summer for his new assignment as Medical Officer to Commander in Chief, Pacific, and Commander in Chief, Pacific Fleet. Admiral Voris was relieved by RADM Ralph E. Faucett, MC USN, who had been Commanding Officer, U.S. Naval Hospital, St. Albans. Admiral Voris was recently inducted as an honorary member of the Blue Key National Honor Fraternity at the Wisconsin State University, La-Crosse, Wisconsin. Blue Key elects to membership those who have demonstrated successful leadership, good character, scholarship and unselfish devotion to the University. Admiral Voris was the first honorary member of the Wisconsin State University Chapter. Admiral Voris has also been awarded the John Jeffries Award for 1969. This award was established in 1940 by the American Institute of Aeronautics and Astronautics commemorating the physician who made the earliest recorded scientific observation from the air. It is given for outstanding contributions to the advancement of aeronautics or astronautics through Aerospace Medical Research. The award will be presented formally at the annual meeting of AIAA in October 1969 at Anaheim, California.

CAPT Henry S. Trostle, MC USN, has been ordered to BUMED as Head, Aerospace Medicine

Flight Safety Branch, with additional duty to Deputy Chief of Naval Operations (AIR). He had been senior Medical Officer, Naval Air Station, Alameda, California since September 1967.

CDR Robert E. Kinneman, Jr., MC USN, has been ordered to Headquarters, Naval Air Systems Command as Special Assistant for Aerospace Medical Matters in the Crew Systems Division. He will have additional duty to BUMED as Head, Aerospace Medicine Equipment Branch. He was Senior Medical Officer, Second Marine Aircraft Wing, Cherry Point, North Carolina since January 1968.

CAPT Richard E. Luehrs, MC USN, was reassigned from duty as Senior Medical Officer, First Marine Aircraft Wing in March 1969 and has reported as Force Surgeon, to Headquarters, Fleet Marine Force, Pacific. CAPT Luehrs has been awarded the Legion of Merit, the Air Medal (with numeral five).

AEROSPACE PHYSIOLOGISTS ATTEND USAF SYMPOSIUM

Three Naval Aerospace Physiologists were guest speakers at the U.S. Air Force Physiological Training Officer Symposium held at Brooks Air Force Base, Texas, 2-6 June 1969.

The speakers and their subjects were: LT D.L. Rhodes, MSC USN, Naval Training Device Center, Orlando, Florida, "Incidence of Bends Following Renitrogenation in Altitude Training Profile"; LT William F. Cunningham, MSC, USN, Naval Safety Center, Norfolk, Virginia, "Ejection Seat Training, U.S. Navy"; LTJG T.E. Northrup, MSC USNR, Naval Aerospace Medical Institue, Pensacola, Florida, "Night Vision Training, U.S. Navy."—AeroMed, BuMed.

HEARING CONSERVATION DATA GATHERED ABOARD USS INDEPENDENCE

Five days were spent aboard the USS INDEPENDENCE (CVA-62) gathering data for studies directed toward the implementation of effective hearing conservation programs aboard aircraft carriers. Hazardous noise areas were located, noise exposure profiles were obtained of personnel working in selected spaces, observations were made as to the type and adequacy of ear protective devices and sound-powered phones used, hearing threshold levels were obtained of selected personnel, and high-quality tape recordings were made of the noise in the various environments. Following their analyses, the recordings will be used in laboratory studies of temporary threshold shift, speech interference, and the evaluation of various ear protective devices.—CO, NAMI, "Howgozit" item for NAVAIRSYSCOM, 10 July 1969.

EDITOR'S SECTION

SOCIETY OF MILITARY ORTHOPEDIC SURGEONS

The Society of Military Orthopedic Surgeons (S.O.M.O.S.) meeting is to be held at the National Naval Medical Center, 22 through 24 September 1969.

Those on the West Coast who are eligible for the military airlift should contact Captain George M. Ricketson, MC USN, NH Oakland, California.

Reserve officers are invited and may apply for this meeting via their district command.

For further information, contact Captain Robert H. Brown, MC USN, Naval Hospital, Bethesda, Maryland 20014.

BUMED FILM RELEASE

The following new film release is presently being distributed to film libraries at naval hospitals:

"You in OPD" (MN–10646)—16mm—color—sound—21 1/2 minutes.

The film dramatizes techniques used by personnel assigned to Outpatient Department in order to make their own work more effective and more enjoyable. Emphasis is on the development of effective relations between staff and patients.

HYMENOPTERA REACTION KIT

The Pharmacy Service, at the Naval Hospital, National Naval Medical Center, Bethesda, Maryland, in conjunction with the Allergy Branch (Medical Service), is issuing Insect Sting Treatment Kits for use by individuals found to be allergic to the stings of various insects. These kits contain the following items:

Isoproterenol Sublingual Tablets
Epinephrine Inhaler
Diphenhydramine Capsules
Tweezers and Tourniquet
Antiseptic Towelettes
Disposable Towel (for Cold Compresses)

The entire contents are packaged in a box 1-1/2 × 6-1/2 × 3 inches in size with complete directions for use. Since the conception of these kits, more than 40 of them have been issued on prescription from the Allergy Clinic.

There are currently over 100 patients receiving hyposensitization in the Allergy Clinic for life-threatening reactions to hymenoptera (bee, wasp, hornet, yellow jacket). Although the injections are protective in over 9 out of 10 cases, there is a time factor involved in the "buildup" process where protection is not adequate. It is during this period that the insect emergency kit may be lifesaving. The aerosolated epinephrine (medihaler EPI) is the most important medication, and a definite improvement over the injectable epinephrine (1:1000) contained in most commercial kits because of its stability and ease of administration to the frequently involved target organ (lung).

AWARDS AND HONORS

Navy Cross

James, Alan C., HM2 USN
Phillips, John C., HN USN

Distinguished Servcie Medal

Cowan, John S., RADM MC USN

Silver Star Medal

Donovan, Thomas S., HM2 USN
Phelps, Huger L., HM3 USN
Seel, Walter P., Jr., HM2 USN
Sullivan, John S., HMC USN

Legion of Merit

Barton, Robert K., CAPT MC USN
Eighmy, Herbert H., RADM MC USN
Sharp, James V., CAPT MC USN

Bronze Star Medal

Bernard, Charles T., HM3 USN
Daly, Terrance J., HM2 USN
Redmon, Douglas R., Jr., HM2 USN
Rossell, Francis L., Jr., HM3 USNR
Taylor, David P., HM2 USN

Air Medal

Luehrs, Richard E., CAPT MC USN

Navy Commendation Medal

Bessette, Robert E., LCDR MC USNR
Buckley, Emanuel N., CDR MSC USN
Bufan, Thomas J., LTJG MSC USN
Clark, Robert P., LT MSC USN
Dempsey, John J., CAPT MC USN
Noll, Emmett E., HM2 USN
Pearce, Henry E., II, HN USN
Perkins, Ray M., HM2 USN
Pickett, Ronald E., HM1 USN
Roberts, David P., HM3 USN
Rupnik, Edward J., CAPT MC USN
Skow, Royce K., CAPT MSC USN
Walton, Robert L., HMC USN
Willett, Leo V., Jr., CDR MC USN

Navy Achievement Medal

Beckham, Ralph L., HM2 USN
Brown, Edward C., HMC USN
Cowl, Clark R., HM2 USN
Dalton, Thomas K., HM2 USN
Koenig, Harold "M" LT MC USN
Levandowski, Thaddeus F. LCDR MSC USN
Rutherford, Gary A., HM2 USN
Screen, Frederick D., Jr., HMC USN

ANNUAL CLINICAL CONGRESS OF THE AMERICAN COLLEGE OF SURGEONS

The Annual Clinical Congress of the American College of Surgeons will be held in San Francisco October 6-10, 1969. A "no-host" Navy cocktail party is planned for 1900 Wednesday evening, October 8, at the Marines' Memorial Club in San Francisco. Reservations may be made by sending a check for $2.00 per person to Captain George E. Crafts, MC USN, Naval Hospital, Oakland, California 94627.

ERRATA

The following corrections should be made in the U.S. Navy Medical News Letter, Vol. 54, No. 1, July 1969.

Page 46, para 3, line 2 should read:
Languedoc in *1290* instead of 1920.

Page 46, para 6, line 6 should read:
. . . in *producing* . . . instead of producting.

Page 48, para 2, line 8 should read:
. . . These 4 legged *sufferers* instead of suffers.

Page 52, Table 1, under Cases the Total should read *546* instead of 59 and under Deaths the Total should read *9* instead of 1.

★U. S. GOVERNMENT PRINTING OFFICE: 1969 393-297/3